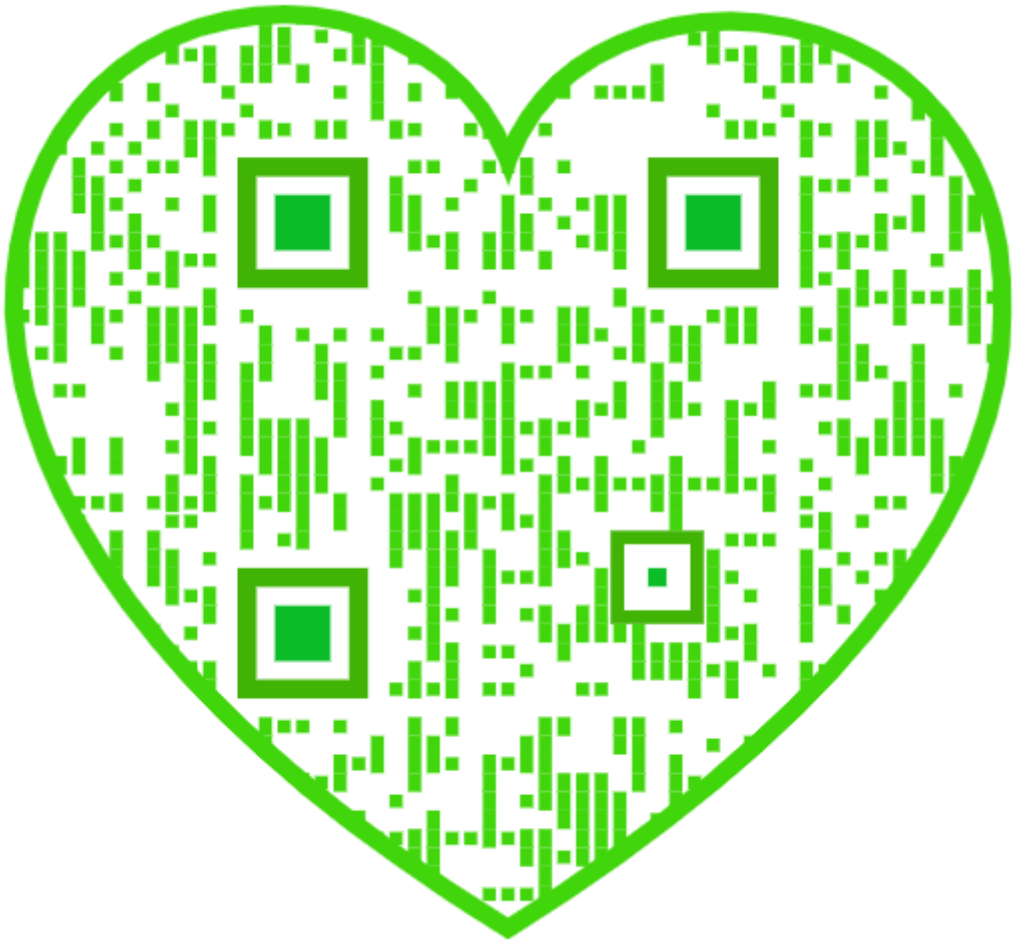

# HISTORY

OF

# EMBALMING,

AND OF

# PREPARATIONS IN ANATOMY, PATHOLOGY, AND NATURAL HISTORY;

INCLUDING

AN ACCOUNT OF A NEW PROCESS FOR EMBALMING.

BY J. N. GANNAL.

PARIS, 1838.

TRANSLATED FROM THE FRENCH, WITH NOTES AND ADDITIONS.

BY R. HARLAN, M. D.

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## NOTE OF THE TRANSLATOR.

It will be reasonably anticipated from the title of the present volume, that it embraces subjects of equal interest to the general and professional reader, as well as indispensable material for the researches of the practical anatomist and student of natural history.

The latter class will find in it all the requisite details for a successful prosecution of its arduous, intricate, but favorite pursuits; whilst those of its patrons of the former class, cannot fail to be interested in the various and important facts and discussions embraced in a general history of embalming from the earliest ages to the present period, so inseparably connected with the moral and physical history of our own species.

An additional subject of interest to all classes will be acknowledged in the facts and observations elicited by the arduous and industrious researches of the author, whilst investigating *the new process of embalming*, which has led to such happy results to the students of anatomy and natural history. The great importance, in all respects, of M. Gannal's discovery, has been fully and adequately acknowledged by the different commissions appointed by the Institute of France, and the Royal Academy of Medicine, who have awarded to its author both honour and profit, as a real benefactor to science, to the progress of which he has so substantially added. The current of the text, together with the notes and illustrations of the translator, embraces all the discoveries of the age, of this nature, of value to the practical anatomist and naturalist, consisting both of original observations, and of highly important information contained in the standard works of De Bils, Ruysch, Swammer-

dam, Clauderus, De Rasière, Dumèril, Hunter, Breschet, Pole, Margolin, Bell, Cloquet, Swan, Parsons, Horner, &c.

Concerning the nature, extent, and merits of the new discovery of M. Gannal, the translator, has spoken in the appendix, from a personal acquaintance with the author and a minute examination of the collection of embalmed objects contained in his cabinet at Paris.

*Philadelphia, September*, 1840.

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## *To Messrs. Members of the Academy of Sciences.*

GENTLEMEN,—From the commencement of my researches upon the preservation of animal matters, you have encouraged me by extending your support to efforts which my own resources would not perhaps have enabled me to continue; in this path strewn with so many difficulties, and disgusts, I have endeavoured to show myself worthy of your high protection.

At a later period, when I was able to offer to physicians and naturalists methods of preservation superior to those previously known, you conferred upon me the prize founded by Monthyon. I have pursued my researches with the view of adapting my process to the art of embalming; the happy results which I have obtained have inspired me with the idea of comparing my mummies with those obtained by processes different from my own.

Finally, I have extended this parallel between my processes and those formerly applied, to preparations of healthy anatomy, to pathological anatomy, and to natural history.

My labour terminated, I have thought it my duty to dedicate to you a work the publication of which is due to the decision which your wisdom and justice have dictated.

Allow me, gentlemen, to consider this dedication as a new encouragement which you are willing to confer upon me, and trust in the respectful sentiments with which I have the honour to be, your very humble and very grateful servant,

GANNAL.

# PREFACE.

I HAD terminated my first researches upon the preservation of animal matters, and proposed to publish them; my notes were collated and my work prepared, when the idea struck me that in place of confining myself to the exposition of the results which I had obtained, I might, with advantage to science, present a history of the art of embalming from the highest antiquity to our time, and compare my processes, with those in use for the preservation of objects of normal anatomy, pathological anatomy, and natural history.

This determination has decided me to publish a volume, in place of a pamphlet of fifty pages.

I had no model to follow, for no author had re-united in the same book, the elements of which I wished this might be composed. I found myself, therefore, necessitated to collect together in the following pages the materials scattered throughout numerous works.

For embalming, *Plutarch, Herodotus, Diodorus Sicculus, Stacy, Pliny, Cicero, Porphyrus, Prosper Alpin, Cassien, Clauderus, Penicher, Baricel, Rodiginus, Corippus, Gryphius, Crollius, the Reverend Fathers Kircher and Ménestrier, De Maillet, Volney, Rouelle, the Count de Caylus, MM. Pariset, Rouyer, Bory de Saint Vincent,* and numerous other authors, have furnished me with descriptions and materials, which I was obliged to put in order and bring before the eye of the reader, in order to present to him a useful lecture, and in some sort preparatory to my own ideas. As my point of departure was scientific data, opinions and facts have come in place as the recital needed them; and thanks to this idea, which has never abandoned

me, the numerous materials from which, in the commencement, I feared disorder and confusion, have come, as if by consent to dispose themselves in order; so great is the influence of a general idea in the arrangement of facts. I believe that I have reduced to exact proportions the art of embalming among different nations. My predecessors had referred too little to *nature*, too much to *man*, in the appreciation of Egyptian embalming; they had not sufficiently estimated the difficulties of the same practice among nations less favoured by climate. Facts reconsidered and interrogated with the aid of lights afforded by the recent progress of physics and chemistry, have furnished us with consequences naturally resulting from their attentive examination.

When the history of an art is followed step by step, as we have done for that of embalming, one is astonished at a psychological fact, equally applicable to every case—we see how idle and common place the human mind is, and how little prone it is to spontaneous activity. The gross and inconsiderate imitation of the Egyptian processes during a long series of ages, is one of the most remarkable examples of this disposition.

Trials directed by a spirit of analysis and critical examination have enabled me to substitute for complex operations, for long difficult and expensive operations, most frequently inefficacious, a simple means, of a determined action, and submitted for several years to the examination of committees appointed by the Academy of Sciences and the Academy of Medicine.

In order to trace the history of the preservation of objects of anatomy and natural history I have had no occasion to go back to an epoch distant from our own; for this science is altogether new. Beyond the discoveries of Chaussier, on the preservative properties of the deuto-chloride of mercury, the labours of MM. Dumèril, Cloquet and Breschet, there is very little existing on this subject. So that I have concluded, after a complete exposition of the preservative means given by these authors, it only remained for me to

propose the preservative substances which, after numerous experiments, have appeared to me preferable to those which they have recommended. They possess a peculiar merit for the formation of cabinets of natural history, that of reducing the expense to at least one-nineteenth.

I have considered it my duty to give here the details of the composition of the liquids employed, either as baths or injections, by the physician and naturalist; the interest of science imposing on me this obligation. But, as regards embalming, the same motive does not exist; I have consequently abstained from giving in totality the means employed in this operation, reserving to myself the care of this process on the request of families or physicians.*

It was not until after many unsuccessful efforts that I succeeded in discovering a method capable of insuring the indefinite preservation of bodies deposited in the earth. A thousand unexpected difficulties arose in my path; and to cite only one, at the end of eight or nine months of preservation, a vegetable production, known to botanists under the name of byssus, for a long time embarrassed me; I tried numerous means, before discovering one capable of suppressing this formation.

The perfection to which I have brought the art of embalming, leaves little to desire. So convinced am I at length of the efficacy of the processes which I employ, that I shall be always ready, at the request of the authorities or of families, to exhume those bodies which I have already embalmed in great numbers, at any expressed period of time.

* This paragraph, evidently empyrical in its bearing, is derogatory to Gannal as a man of science. We further believe that the pretended secret of his manipulations is of little consequence to the success of the operation: it is generally understood that to the fluid acetate of alumine (produced by the chemical action induced by the mixture of the solutions of acetate of lead and alum,) to be injected, a little arsenic is added, to prevent the formation of the byssus, and attacks of insects, also some carmine, to give to the subject a healthy colour.—*Tr.*

# INTRODUCTION.

The Egyptians embalmed their dead, and the processes which they employed were sufficiently perfect to secure them an indefinite preservation. This is a fact of which the pyramids, the caverns, and all the sepultures of Egypt offer us irrefragible proofs. But what were the causes and the origin of this custom? We have in answer to this question only hypothesis and conjecture. In the absence of valid documents, each one explains according to the bias of his mind, or the nature of his studies, a usage, the origin of which is lost in the night of time. One of the ancients informs us that the Egyptians took so much pains for the preservation of the body, believing that the soul inhabited it so long as it subsisted. Cassien, on the other hand, assures us that they invented this method because they were unable to bury their dead during the period of inundation. Herodotus, in his third book, observes, that embalming had for its object the securing of bodies from the voracity of animals; *they did not bury them*, says he, *for fear they would be eaten by worms, and they did not burn them, because they considered fire like a wild beast that devours everything it can seize upon.* Filial piety and respect for the dead, according to Diodorus Siculus, were the sentiments which inspired the Egyptians with the idea of embalming the dead bodies. De Maillet, in his tenth letter upon Egypt, refers only to a religious motive the origin of embalming: "The priests and sages of Egypt taught their fellow citizens that, after a certain number of ages, which they made to amount to thirty or forty thousand years, and at which they fixed the epoch of the great revolution when the earth would return to the point at which it commenced its existence, their souls would return to the same bodies which they formerly

inhabited. But, in order to arrive, after death, to this wished for resurrection, two things were absolutely necessary; first, that the bodies should be absolutely carefully preserved from corruption, in order that the souls might re-inhabit them; secondly, that the penance submitted to during this long period of years, that the numerous sacrifices founded by the dead, or those offered to their manes by their relations or their friends, should expiate the crimes they had committed during the time of their first habitation on earth. With these conditions exactly observed, these souls, separated from their bodies, should be permitted to re-enter at the arrival of this grand revolution which they anticipated—remember all that had passed during their first sojourn, and become immortal like themselves. They had further the privilege of communicating this same happiness to the animals which they had cherished, provided that their bodies inclosed in the same tomb with themselves, were equally well preserved. It is in virtue of this belief that so many birds, cats, and other animals are found embalmed with almost the same care as the human bodies with which they have been deposited. Such was the idea of perfect happiness which they hoped to enjoy in this new life. In expectation of this resurrection, the souls inhabited the airs nearest the dwellings where reposed the bodies they had animated. But superstition alone, it could scarcely be believed, would induce men to save from destruction the mortal spoils of individuals whom they had loved whilst living. I much prefer looking for the source of this usage in the sentiment which survives a cherished object snatched from affection by the hand of death. Since death levels all distinctions—respecting neither love nor friendship,—since the dearest and most sacred ties are relentlessly broken asunder, it is the natural attribute of affection, to seek to avoid in some degree, a painful separation, by preserving the remains of those they love and by whom they were beloved. Love, tenderness, and friendship, do not terminate with the objects which gave them birth—they survive and follow them even beyond the tomb."—*(Bory de*

*Saint Vincent, Essay on the Fortunate Islands.—Embalming of the Guanches.)* The same author adds: "The custom of preserving their dead, which was only national among the Egyptians and Guanches, that is to say, with men the least instructed, and a nation the most learned, is, as we have said above, proof of a profound sensibility among nations with whom it is general. Without doubt, an enlightened policy would contribute much to introduce, extend, and confirm the practice. It proves an intelligent government, one full of solicitude for the happiness of its subjects." The opinion of Volney, revived and adopted by Pariset, in his memoir on the causes of the plague, is closely allied to the preceding. "In a numerous population, under a burning climate, and a soil profoundly drenched during many months of the year, the rapid putrefaction of bodies is a leaven for plague and disease. Stricken by these murderous pests, Egypt, at an early day, struggled to obviate them; hence have arisen, on the one hand, the custom of burying their dead at a distance from their habitations; and on the other, an art so ingenious and simple, to prevent putrefaction by embalming: a secondary precaution, more important and more efficacious, with which the primary could not dispense, and which, exacting attempts, trials, and experiments, could only be obtained as a last result—an art by no means expensive, of a simplicity and facility of execution, which rendered its immediate application popular, general, and, perhaps, uniform for all dead bodies. Research and luxury followed at a later period." The sentiments to which the authors above cited attribute the origin of embalming among the Egyptians exist in every man, viewed either as a social or isolated being. One individual may be induced to embalm the bodies of his relatives or friends by motives of superstition; another from egotism or personal interest; a third from motives of salubrity or common interest; another, in fine, is impelled by an instinctive affection to perform the sacred duty of preserving the remains of those who were dear to him. But none of these mo-

tives possess a character of generality and perpetuity, which consecrates a usage and renders it popular; it was therefore left to government to interfere and give it the force of law.

The noble sentiments of affection, of respect, and of veneration, had then, without doubt, the priority; and everything proves to us that these inspired the admirable art of embalming, and that they were above all invoked by legislators.

Nature, besides, upon this torrid soil, gave the first idea of this mode of preserving the remains of men and animals: the mummy[1] of the sands, a natural phenomenon, was a revelation to a people so wise and industrious. The course of our work will demonstrate, we hope, the simple connection of these facts; it had already arrested M. le Comte de Caylus, who, in a memoir read to the Academy of Inscriptions and Belles-Lettres, in 1749, thus expresses himself: "The Egyptians, according to appearances, owe the idea of their mummies, to the dead bodies which they found buried in the burning sands which prevail in some parts of Egypt, and which, carried away by the winds, bury travellers and preserve their bodies, by consuming the fat and flesh without altering the skin."

The same opinion is advanced by Rouelle. In our general history of the preservation of the human body, the mummy of the sand, and those induced by other local circumstances, will have the first place; and the art of embalming among the Egyptians and the Guanches will occupy the second. This art, we have already said, presents among these people, a general character, which does not appear in any other country. No where, indeed, are the processes of preservation so efficacious, and these two nations alone, have been able to endow their mummies with the power of resisting destruction.

[1] *Momie* or *mumie*: the etymology of this word is not well known: the Jesuit Kircher supposes that *mum* is a Persian word, and Pére Martini, an Arab name, signifying a dried corpse: other writers derive mummy from *amomum*, the name of an aromatic plant. These conjectures I leave to the etymologists.

We shall see in the sequel this custom establish itself among the Jews, the Greeks, the Romans and moderns—but it no longer displays a general character; it is no longer a law, a social institution; religious belief, superstition, personal interest, salubrity, no longer obliged them to recur to it. Sentiments of veneration, respect, and attachment, to which we have given the priority to all others, sufficed to perpetuate this custom, and have preserved it for a long series of ages, from the epoch of the Jews, down to our day.

Joseph commanded the physicians in his service to embalm the body of his father, which they executed according to order, in the space of forty days.—*(Genesis.)*

Saint John informs us, that Nicodemus took a hundred pounds of a mixture of myrrh and aloes, with which to embalm the body of Jesus Christ, which they enveloped in sheets with aromatics, according to the usual mode of burying the dead among the Jews.

Testimony of a similar nature, transmitted to us by historians, show us this usage in vigor among the Persians, the Arabians, the Ethiopians, &c.: for kings, princes, and persons of distinction, to whom they would not consider that they had rendered the respect due to their memories if they had failed to preserve preciously what remained of them.

Corippus, in his funeral oration on the Emperor Justinien, thus expresses himself on the embalming of this emperor:

> "Thura sabæa cremant, fragrantia mille
> Infundunt pateris, et odoro balsama succo, locatis
> Centum aliæ species; unguentaque mira feruntur
> Tempus in æternum sacrum servantia corpus."[1]

The Romans, nevertheless, often contented themselves, in washing and rubbing the body with certain perfumes.

> "Tarquinii corpus bona femina lavit et unxit."[2]

[1] They burned the incense of Arabia, balms and perfumes of every kind filled a thousand vases, and the body is for ever preserved from corruption by essences possessing wonderful properties.

[2] A benevolent woman washed the body of Tarquin, and rubbed it with perfumes.

The Egyptian mummies, which are distinguished from those of other nations by the admirable state of preservation in which we find them at the present time, have been for the philosopher a subject of interesting study and research,—for the ignorant, a cause of astonishment and superstitious fear; for physicians, an empyrical remedy for a long time in vogue. The history of Razevil, the Pole, proves the evil influence attributed to mummies. He had purchased at Alexandria, two Egyptian mummies, one of a man, the other of a woman, in order to take them to Europe; he divided them into six pieces, which he separately enclosed in as many boxes, made of the bark of dried trees, and in a seventh box he placed idols discovered with the two bodies. But, as the Turks forbid the sale and transport of these mummies, fearing lest Christians might compose some sorcery of them to the injury of their nation, the Polonaise concluded to bribe the Jew commissioned to examine the bales and merchandise. The plan succeeded, the Jew shipped all the cases as shells, to be transported to Europe. Previous to setting sail, I found, says he, a priest returning from Jerusalem, and who could not accomplish his voyage without the aid which I gave him on this occasion, in inviting him to take passage in our ship. One day, whilst this good man was occupied in counting his breviary, there arose a furious tempest, and he warned us, that besides the danger, he perceived two great obstacles to our voyage in two spectres, which continually haunted him: the tempest over, I taunted him as a visionary, because I never imagined that my mummies could have been the cause of it. But I was obliged in the sequel to change my opinion, when there happened another storm, more violent and dangerous than the first, and when the spectres again appeared to our priest whilst he was saying his prayers, under the figures of a man and woman dressed as my mummies were.

When the tempest was partially appeased, I privately threw overboard the seven boxes, which was not so adroitly executed, however, but that the captain got notice of it,

when, with great delight, he promised us that we should have no more storms; which effectively happened, and the good priest was troubled with no more visions. I had a severe reprimand from the captain for having embarked these mummies in his vessel, against which the sea had so great antipathy. The theologians of the isle of Crete, where we anchored, justified my conduct, acknowledging that it was lawful to Christians to transport these mummies for the assistance of the infirm, and that the church did not forbid the usage."

The judgment of the theologians of the isle of Crete, proves that the employment of the mummy as a medicine was universally admitted. According to Dioscorides, it is heating and drying in the second degree—it relieves the headach, cures megraim, palsy, and epilepsy—wonderful in relieving vertigo and drowsiness—an antidote against poisons of all kinds—the bite of venomous beasts—useful, according to Rhasis, in the spitting of blood, rupture of blood-vessels, wounds, &c.;—in one word, no remedy was esteemed more efficacious for the human body, than the human body taken as a medicine. One dram of the oil of mummy of Paracelsus, rendered all poisons innocuous for twenty-four hours; the formulæ of Crollius, of Fernel, of Clauderus, produced effects equally miraculous. The *divine water of Scroder*, was the touch-stone by whose aid the issue of a disorder could be known in advance: a dram of this liquor was mixed with nine drops of the blood of the patient, or with a double proportion of his urine; if these fluids did not mix, it was an infallible sign of approaching death; on the other hand, if they mixed readily, you might anticipate the health or cure of the patient in twenty-four hours. The great king, Francis 1st, wore around his neck a piece of mummy as a preservative against all evils. Powerless preservative!

I have designedly placed, after an example of superstition, facts which prove the stupidity, or charlatanism of the profession, it appearing to me instructive to preserve the progressive ascendency; the march from the little to the great,

in ridicule, as in everything else, is absurd. The difficulty of obtaining mummies enough to satisfy the demand, gave rise to an abominable traffic, against which many physicians remonstrated. "The base avidity of gain increased daily, and they commenced embalming with salt and alum the bodies of those who had died of leprosy, of plague, or small pox, in order to obtain, in the course of a few months, the cadaverous rottenness which flowed from them, and to sell this for true and legitimate mummy; and even at the present time, they make no scruples to give the name of mummy to the dead bodies found in the Deserts of Arabia, and make patients take it internally."—*(Durenou.)* The characters of a mummy of good quality, had, nevertheless, been well determined. "Those bodies are not mummies," says Penicher, "dried by the sands of Lybia, nor those buried and preserved beneath the snow; nor those bodies submerged by the sea, thrown up and dried on the coast, even to the last degree of blackness; nor of criminals, hung and dried in the sun—for these are of no use."—*(Ant. Santorel.)* The Pissasphaltum, which is the mummy of the Arabians and the ancients, according to Serapion and Avicenna, is not what we desire; because the odour is disagreeable, and it can possess no other virtue than a mixture of pitch and *asphaltum.* Neither is mummy a certain fluid which flows from the coffins of embalmed bodies, mentioned by Dioscorides and Mathioles, and which is only, properly speaking, a mixture of humours, mixed, soaked, and penetrated by aromatics, of which the embalming consists.

*Andrew Gryphius* teaches us, that a good mummy ought to be reddish, light, greasy, and with some odour, but as the embalming materials vary much, as well as their quality, the bodies being more or less well preserved, and it is even possible they may be poisonous, it has appeared expedient to compose a mummy methodically digested. Among the numerous formulæ for officinal mummies, we shall content ourselves with citing here that of *Crollius.*

*Mummy of Crollius.* Choose the body of a hanged per-

son, preferring one with red hair, because in this sort of temperament the blood is thinner; the flesh impregnated with aromatics is better, being filled with sulphur and balsamic salt; it ought to be about twenty-four years of age, healthy, whole, and of good constitution; you will take pieces of the flesh of this corpse, *they would be still better if taken from the body of a living man;* notably, from the thighs, buttocks, &c.; strip them of their arteries, nerves, veins, and fat, and then wash them well with spirits of wine; then expose them to the sun and moon for two days, during mild and dry weather, to the end that the action of the rays of light of these two planets, particularly of the sun, may exalt and liberate the principles concentered in the flesh; powder it with myrrh, styrax, aloes, saffron, which constitute the basis of the elixir proprietatis of Paracelsus; having previously rubbed the flesh with true balm, macerate it for twelve or fifteen days in a well corked vessel with first quality spirits of wine and salt, which form of themselves a species of balm: at the end of this time withdraw the flesh, let it drain, and dry in the sun; let them again, for the same space of time, and in the same manner, macerate in a similar fluid, and expose it afterwards to the sun and fire, in the same manner they do hams; flesh thus prepared will be found to be an excellent mummy."

Conceding that the use of the mummy in medicine is one of the strangest and most extravagant abuses of empyricism, the officinal mummy of *Crollius* must be considered as an improvement, inasmuch as it is divested of the dangers attached to other mummies; it was even a benefit, for this remedy divested of the marvellous, reduced to the level of a common drug, was justly appreciated and soon forgotten. The art of embalming among the Egyptians and Guanches, was carried to a degree of perfection attained by no other nation who followed their example. And, nevertheless, what are the mummies of these countries? They are, according to the definition of R. P. Kircher, bodies stuffed and filled with odoriferant, aromatic, and balsamic drugs, capa-

ble of arresting the progress of putrid decomposition. Numerous incisions enabled the preservative matter to enter the cavities and deep tissues: agreeably to the relations of Herodotus, of Diodorus Sicculus, and of Porphyrus, the cranium was emptied either through the nostrils, or by an opening made in one of the orbits: the contents of the thorax and abdomen were withdrawn and placed in a trunk. "The Egyptians," says Plutarch, "drew the intestines from the dead bodies, and, after having exposed them to the sun, cast them away as the cause of all the sins committed by man."

The moderns have adopted an analogous mode of preparation, and in our days, previous to my researches on the preservation of animal matters, the processes of embalming were long and complicated.

In the Dictionary of Medicine, of twenty-five volumes, *(Paris*, 1835,) M. Murat traces in these terms the rules for embalming:

"Before commencing this operation, it is necessary to procure the following objects: alcohol saturated with camphor, camphorated vinegar, a varnish composed of the balsams of Perou and copaiba, fluid styrax, the oils of Muscat, of lavender, and of thyme, &c., alcohol saturated with protochloride of mercury, a powder composed of tan, of decrepitated salt, of quinquina, of cascarilla, of mint, of benzoin, of castor, of Jew's pitch, &c.—all these substances mixed and reduced to a fine powder, are sprinkled with essential oils. The powdered tan ought to form nearly half the weight, and the salt one-fourth; there ought also be placed, at the disposition of the embalmer, a certain number of bandages, linen, sponges, and waxed threads, also several basins filled with pure water, &c.

"The breast and belly must be opened by large incisions, and their contents extracted; the brain is removed after the necessary incisions of the scalp, and sawing circularly the bones of the cranium; deep and repeated incisions are to be made in the viscera. If we wish to preserve the intestinal

tube, we must open it throughout its whole length, wash it well in water and compress it; wash it a second time in camphorated vinegar, and finally with camphorated alcohol. Large incisions must be multiplied on the interior surfaces of the great cavities, and along the extremities."

I stop at these details, because they suffice to prove that the art of embalming, down to the present, has had for its object, not the preservation of the whole subject intact, but the preparation of animal matters padded, stuffed with aromatics and salts: a preparation always incomplete, tedious, and expensive. This is the point from which I start in the preservation of animal matter, and the art of embalming. Have I the happiness of adding a step to science? my readers shall be the judges.

The Academy of Sciences, and the Royal Academy of Medicine, have proved that, by one of my processes, subjects destined for dissection can be preserved. Bodies kept for several months, and afterwards carried to the amphitheatre, have been found as fresh and as fit for dissection, as individuals dead only two days.*

These early successes, and the honourable encouragements which they have received, gave me the idea of bringing the art of embalming to perfection; and I have attained to the power of preserving bodies, *with all their parts, both internal and external, without any mutilation or extraction, and so as to admit of the contemplation of the person embalmed, with the countenance of one asleep.*

This discovery has been confirmed by a commission of the Academy of Sciences, who, in its public sitting in the month of August, 1837, conferred upon me the grand prize.

Having decided to publish the result of my researches, I thought it best to precede it by a general history of embalming, and it appeared to me that a book which would re-

* The colour of the tissues is changed, however, being bleached by the acetate of alumine—but this is far preferable to the black putridity, which renders the anatomical subject so disgusting and unhealthy, when subjects are scarce.—*Tr.*

unite so many interesting documents up to the present time scattered throughout so many works, would not be without interest. If my readers join with me in this opinion, I shall not have laboured in vain, and my work shall have received that recompense of which I am most ambitious.

Nevertheless, I conceived that my endeavour should not be restricted to the simple exposition of my researches, and that it was a duty I owed, to place at the disposition of my fellow citizens the means of continuing some relations with the remains of persons whom they had held dear. The sentiments of love, friendship, respect, and veneration, which preserves in our hearts as a sacred depôt, the memory of friends and relations, give, even to an indifferent portrait, which recalls their features to us, an inappreciable value. The heart warms and vivifies this faint image, and recalls to us the words and actions of those who have departed.

These same sentiments cause us painfully to experience the full rigour of that law of nature which condemns to the decomposition of the grave, remains so sacred to us. I have desired to offer to persons groaning under an afflicting loss, the means of preserving all that death has left them; with this intention I have founded an Embalming Society, and I have placed the price for this operation within the reach of the majority of persons. For men destitute of resources, who have rendered themselves worthy, by their talents or virtues, of the remembrance of their species, the public authorities may reclaim of us a gratuitous embalming. We shall be happy to preserve to society the mortal spoils of those who honour and are useful to it.

# HISTORY OF EMBALMING.

## CHAPTER I.

### OF EMBALMING IN GENERAL.

As soon as life ceases in animal matter, disorganization commences; the constituent elements separate, to be variously recombined, and to give birth to new compounds.

The elevation of atmospheric temperature in certain determined hydrometric limits, and the action of oxygen, are those circumstances which lead necessarily to this decomposition. But, at a given temperature, the progress of putrid fermentation is not the same for all animals; this varies among different species, and different individuals of similar species, according to laws not well determined. But so important, however, are these laws, to the art of embalming, that processes which are sufficient for the perservation of one body, may fail in their application to others.

The ancients had well observed, it is true, that the diversity of climates contributed much to the difference in mummies, and to the success of embalming; for, according to *Camerarius*, great difference exists between the bodies of Europeans and

Orientals; the latter, of a dryer temperament, are not exposed to so rapid a decomposition. The example related by *Ammian Marcellni* is a convincing proof. Four days, says he, after a combat between the Persians and Romans, the countenance of the latter could scarcely be recognised; the bodies of the Persians, on the contrary, were dry, without humidity, without sanies, and without any alteration.

If sufficient attention is given to this fact, and we consider further, that the thermometrical and hygrometrical conditions of the atmosphere were such in Egypt, that the bodies abandoned to themselves, become dried and formed natural mummies, we shall perceive how vain and unreasonable have been the attempts of those who, for a long series of ages, expected in the middle and northern portions of Europe to embalm human bodies by processes which are only an imperfect imitation of those of Egypt, even in what is defective. Finally, we shall understand how it happens that the sepulchres of the Guanches and Egyptians, yield bodies in such a perfect state of perservation, whilst those of our country offer only bones and dust.

Whilst according to the Egyptians the just tribute of admiration which their profound wisdom and extensive acquirements merit, we ought, in a scientific question, to defend ourselves from the infatuation of our predecessors, which led them into error, and appreciate at their just value facts badly observed.

We read in the letters of M. de Maillet, "the dry and nitrous earth of Egypt has the property of na-

turally preserving entire bodies without the aid of any art, especially in those countries at a distance from the Nile. This is a fact which experience does not permit us to doubt. Not long since, there were buried some Frenchmen, in a Coptic church which is in old Cairo, and those who descended the cavern found the bodies of others who had been previously deposited for some time, as perfect as they were the very day that they were inhumed: The clothes even of a Venetian consul, whose corpse had been here interred, were perfectly preserved. I have likewise visited several ancient Mosques, formerly celebrated, but now in ruins, which are situated on the road from Cairo to Suez; these edifices have served as tombs to some Mahommedan kings, whose bodies were here deposited, during the period when Egypt was subject to the Arabs. I investigated some of these caverns, and can assert that I observed bodies so light from desiccation that they could be raised with one hand as easily as if they were a walking stick. Among these bodies, was one which weighed less than four pounds; I saw also a thigh, which, although it appeared entire and full of flesh, with the leg and foot attached, did not weigh one pound. Finally, the same thing is daily observed by the caravans which go to Mecca. There are none of these wanderers who have made this voyage, who could not testify that the bodies of those who die on the route, are dried to such a degree as to become as light as straw."

If, then, we would wish to judge *a priori* of the relative value of the processes of embalming, followed by the people of Asia and Africa, and of those

employed by European nations, we ought to start from this double fact—that among the first, bodies abandoned to themselves have a tendency to dry and mummify, both on account of the small quantity of fluid they contain, and on account of atmospheric influences; whilst those of the second, rot and dissolve under the influence of contrary causes.

We think then, with M. Rouyer, member of the Egyptian commission, that the most efficacious cause of the perfection of the art of embalming of the Egyptians, and of the wonderful preservation of the mummies, was the climate of Egypt, and chiefly that elevated and equal temperature (20° R.) which exists in the interior of sepulchral chambers, and in all subterranean places specially consecrated to sepulchres. A fact which ought to be joined to this last, has been proved by MM. Docts. Boucherie, Bermont, and Gaubert, during a visit to the caves of St. Michle at Bordeaux. These caverns which contain seventy bodies, taken from the neighbouring sepulchres forty years ago, and mummified by causes of which we shall speak in the sequel, are of a temperature of eighteen degrees.

In order to terminate this discussion by a fact universally known, the mummies preserved untouched for several thousand years in the caverns of Egypt, become altered and destroyed very rapidly, when transported into Europe, and divested of their bandages, they are exposed to the influence of our atmosphere.*

* The above observations on the natural mummies of caverns, &c., apply equally to the numerous specimens of Indian mummies found in Peru, Brazil, the Western States of North America, &c.—*Tr.*

These various observations convince me that a precise knowledge of the art of embalming among the ancients, would not suffice to preserve bodies in our country; and what we do know, decides me to push my researches in another direction.

Besides, the methods for embalming have varied with time, place, and circumstances. The Ethiopians, inhabiting a country which furnishes in itself more gum than all the rest of the world, conceived the idea of enclosing the body in a melted

In the autumn of 1839, in my journey down the Rhine, I visited Popplesdorf, near Bonn, where there is an ancient church, formerly a monastery, called "the Kreuzberg." It is situate on a high and dry hill. I descended its vault in order to examine some two dozen of mummified monks, some of them four centuries old. They were all habited in the costume of the period, and appeared to have died at an advanced age. These are natural mummies, or the result of simple desiccation, the skin resembling leather. It is probable that we may refer to similar causes, those interesting subjects discovered three or four years ago, in a cave of the church of St. Thomas, at Strasburg, viz., the mummified bodies of the Count de Naussau (*Sarsbruck*) and his daughter. These relics, six hundred years old, are both habited in the costume of that epoch; the coat, small-clothes, &c., of the father, have been replaced by exact imitations, but the habits of the daughter are actually those in which she was buried, consisting of a blue silk gown, richly ornamented with lace, with diamond rings on her fingers, and jewels on her breast. The body is well preserved, with the exception of the face: bunches of silvered flowers still adorn the top of the head, arms and shoulders. The features of the Count are almost perfect. I could not observe any external signs of artificial embalming having been resorted to. The skin was of a yellowish colour. The famous mummy of St. Carlo Boromeo, in the vault of the splendid Duomo di Milano, is another remarkable instance—the body is as black and solid as an Egyptian mummy; it was removed from a cemetry in the vicinity, after having remained there many years; no artificial means had been resorted to for its preservation.

The climate and soil of Egypt have been equally efficient in preserving vegetable life. The French naturalists who accompanied the army to Egypt, sent home fruits, living seeds, and other portions of twenty different plants, including the common wheat and onion of the present day—as was proved by the germination of the seeds and roots in Europe.—*Tr.*

mass of this transparent matter, and thus to preserve them like insects enveloped in fluid amber, and which are found uninjured and very visible in the middle of this substance when solidified. This mode of preservation has led some to suppose, that the Ethiopians preserved their dead bodies in glass. Honey was formerly used for embalming; the body of Alexander the Great was rubbed with honey, as the following verses prove:

> "Duc et ad æmathios manes, ubi belliger urbis
> Conditor hiblæo perfusus nectare durat."

This use of honey is further confirmed by J. B. Baricel, André Rivin, and R. P. Mènestrier. Pliny, book xxii. chap. 24, says that honey is of such a nature, that bodies placed in it do not corrupt.

They made use also of wax for embalming, as we read in Emilius Probus, at the end of the life of Agésilas: "Having fallen sick, he died, and that his friends might the more conveniently carry him to Sparta, for want of honey they enveloped his body in wax." The Persians, on the report of Cicero, employed the same matter: Persæ jam cerà circumlitos condiunt, ut quam maximè permaneant diuturna corpora.

The ancients also made use of a sort of brine, the composition of which is unknown. Cœlius Rodiginus, in his book of antiquities, remarks that, during the pontificat of Sextus IV. they found on the Appien way the body of a girl, retaining still all the beauty of her face, the hair of a golden blond, and tied up with bands, also gilded—it was thus preserved in a brine, which entirely covered it, and it was thought to be the body of *Tulliola*, the daughter

of Cicero. And Valateron assures us that, by a preparation of an unknown salt, the body of another female was also found entire in a mausoleum near Albania, in the time of Alexander VI.; this Pope ordered it to be thrown secretly into the Tiber, fearing the superstition of the people, who run from all parts to see it, because the body still retained its beauty, although thirteen centuries had elapsed since its deposition.

The Jews, after closing the mouth and eyes of the dead, shaved them, washed and rubbed them with perfumes, then enclosed them in a coffin along with myrrh, aloes, and other aromatics, in great profusion.

The Egyptians had a great number of processes for embalming. The valuable work of M. Rouyer places this fact beyond a doubt: *natron, cedria, bitumen, asphaltum, pisasphaltum*, different aromatic substances to drive off insects, varnishes, more or less costly, were used in their different preparations; finally, bandages multiplied, and endued with gum Arabic, closed all access to air and humidity. The mummies of the Guanches, which so closely resemble some of those of Egypt, were sewn up in skins, after having been stuffed with aromatics and dried in the sun.

The moderns have employed for the preservation of dead bodies, numerous substances both fluid and solid; spirits of wine, oils, tinctures, compound liniments, brines, etc., constitute the first class; powders, composed of all parts of balsamic and aromatic plants, form the second.

We shall examine, hereafter, more in detail these

various systems of preservation—nevertheless, what we have mentioned, proves that they were only in a slight degree efficacious. And even the so much boasted methods of Clauderus, Derasieres, &c., and the wonderful secrets of Debils, Ruysh, Swammerdam, appear to us only applicable to retard a little while the progress of decomposition. The following is extracted from the article *Anatomical Preparations* of the Dictionary of Medical Sciences:

"It is said that Ruysh possessed the means of preserving the flexibility and other vital properties of the different tissues of our bodies. When the Dutch anatomist sold his cabinet to the Czar, Peter I., he gave a manuscript in which he made known the composition of a preservative fluid, expressly stating that this liquor was nothing more than spirits of wine; the spirit of malt, to which was only added, during distillation, a handful of white pepper. But it appeared that Ruysh had not given the true composition of his liquor, or rather, that he had exaggerated the virtues of it, for it is far from possessing the effects which have been attributed to it. After the death of Ruysh, they thought they had discovered his means of preserving. In 1731, Geoffroy was charged to make experiments; but the results did not correspond to the anticipations."

We find in a note added by Strader, at the end of his edition of the works of Harvey, another version relative to the proceedings of Swammerdam, which is as follows:

"It is with reason," says he, "that we prefer to the Egyptian method, an art which so hardens dead bodies, that they lose nothing of their substance,

and change neither in colour, nor in form; that they leave to the anatomist all desirable leisure for examination, without presenting any effusion of blood, nor that disgusting filth so repugnant to the delicate practitioner, and which frequently prevents the examination of the entrails of subjects.

"I shall publish, as was communicated to me, this admirable process, in which I was formerly liberally initiated by Cl. Dn. Swammerdam, which is beyond all praise. It is necessary, then, to obtain a pewter vessel of sufficient size to contain the body to be embalmed; place at the distance of about two fingers depth of the bottom, a hurdle of wood, pierced with many holes; place the body on this hurdle, and pour on oil of turpentine to the height of three fingers, keep the vessel quiet, tightly, and less and less hermetically covered during a certain space of time; in this manner the oil, of a penetrating nature, will infiltrate by degrees into the body on which it is poured, and will expel the aqueous portions, the principle cause of the fermentation which tends to corruption. This aqueous portion descending by its specific gravity, and distilling through the flesh, will, in time, occupy the space between this and the bottom, and during this time the more subtle part of the balm will exhale, as the vessel is less closely covered; the more it evaporates, the harder the body becomes, and will imbibe the thick lees of the oil, the effect of which may be compared to that of a gummy marrow: it can then, consequently, remain out of the liquor and in open air without corrupting, without any fear of putrefaction, or of the worms. As to the time necessary to allow

the body to remain in the balm, this varies according to the nature of the subject to be preserved. The following rules on this head must be observed:

"The embalming of an embryon of six months, may be accomplished in about the same length of time.

"The skeleton of the same embryon requires only about two months.

"The membranes of the heart, three months.

"The vessels of the liver, and of the placenta, cleared of their flesh, one month.

"The vessels of the spleen, ten days.

"The intestines, one month.

"A certain time is thus assigned for other vessels, which would not be difficult to discover or determine by experiments.

"It is always necessary to pay attention, that during this operation, the parts be a little contracted and compressed in an equable and convenient proportion; the coction of the body prevents the skin forming wrinkles, whether it be made before the deposition in the oil, or after it has soaked there for two months. In order that the subject may retain all its beauty and whiteness, it must be macerated for several days in alum before embalming it. In order that the members may retain a convenient form and position, they ought to be plunged into the balm on the commencement of winter, about the month of November, to expose them afterwards to the cold, not to freeze, but to harden them lightly.

"In following this process, with care, we destroy entirely all the germs of putrefaction concealed in the body, to such a degree, that the entrails even

are profoundly penetrated with this balm, and are able to resist the constant attacks of the air.

"If it is desired to preserve a part, without the process above mentioned, the blood must first be extracted by a brine, and the salt subsequently withdrawn by rain water, and, after having placed it in the shade to prevent its putrefying, endue it with a mixture composed of three quarts of oil of turpentine, and one quart of mastic, which will communicate a brilliant appearance to it, and even a sort of light crust, particularly if a greater quantity of mastic is used in the preparation.

"As regards the preparation of the members and their appendages, a particular process must be observed. The vessels must be well dried, of whatever matter they may consist, and afterwards place the rods in them well fitted to the cavity; and previously endued with suet, which is to be carefully withdrawn in a few days; thus the members, large and small, ought to be placed in cotton, well soaked in suet, to be stretched in the direction of their length, as, for example, we stretch the meshes of capillary vessels on sticks rubbed with suet, from whence they are readily detached by means of a little fire placed beneath, which causes the suet to melt.

"But sufficient has been said for the present; perhaps, hereafter I shall have a more favourable opportunity to relate other similar facts, or even more admirable; for I have seen with Swammerdam, of whom I have spoken above, various pieces embalmed with so much talent, that, besides all their natural properties, they possessed also that of being always

soft and flexible; I must forbear transmitting for the present this process, in order not to lessen the èclat of the fine work I have just described, and in introducing a still more beautiful one on the scene, etc."

After so precise a description, I hoped to make something out of this process; but nevertheless, I must confess, that after having repeated these experiments with the greatest care, I was no more successful in my trials than Mr. Geoffroy was in 1731; only I have proved that, when bodies are prepared according to my process, and afterwards plunged into turpentine, they preserve a remarkable freshness and suppleness. After much reflection upon this subject, I have come to the conclusion, that Ruysh and Swammerdam have never made known but a part of their system of preservations, and that, previously to immersing the body in either of the two liquids of which we have spoken, they subjected them to some preparation. In fine, those very authors who boast of the admirable perfection of their processes, have not left a single preparation to show as an example to justify their praises; and, as a proof of their exaggeration, we have the testimony of an author (*Penicher*) profoundly versed in this matter. "Those authors," says he, "who boast of having embalmed without emptying the great cavities, and by confining themselves to injections by the mouth, by the anus, or by holes made in the armpits, would be embarrassed to show satisfactory results from such superficial embalming; for, sooner or later, these nuisances will overcome all the embalmer's industry, and all the expense he may have been at to

conquer a bad impression." Could there exist a more singular proof of this, than what happened a few years ago in the church of R. R. P. P., respecting the body of a lady of first quality? The corpse had been placed in a leaden coffin, and enclosed in another of wood, and placed within a marble mausoleum well cemented; after which, in order to fulfil the will, it was embalmed, and enveloped in two hundred pounds of aromatics and perfumes; two kegs of aromatic spirits of wine were introduced through an opening, so that the body was completely submerged in it. Nevertheless, at the end of twelve years or thereabout, it produced so dangerous and malignant a stench through the cracks which occurred in the coffin, by the expansion of the drugs, that one of the priests, who chanced at the time to be saying mass in his chapel, fell extremely ill from this cause, and the assistants were obliged to withdraw, being unable to support the effluvia.

The priests were under the necessity of exhuming the body, with the consent of the archbishop, and family of the deceased; they removed it to the garden, placed it in a ditch, and covered it with quick-lime, which not destroying the flesh, composed of oily, sulphurous, and resinous parts, it was found necessary to remove the flesh from the body, in order to replace the skeleton in the mausoleum; to such a degree did the bad qualities of the entrails and viscera, corrupted by disease, surpass the good qualities of the balms. The imperfections of these methods grow out of their very nature. Along side of these embalmings, practised in an empyrical

manner, without any reference to the qualities more or less efficacious, of the aromatic and balsamic substances, I can place infants several months old, subjects most susceptible of dissolution, *and which, after a simple injection, have remained exposed to the air in a moist room.* At the end of two years of this exposure, they displayed a great suppleness of the tissues, without the least trace of decomposition. Those which I enclosed in cases, in the midst of an atmosphere of my own discovery,* have preserved exactly the expression and colour of the face, that they had at the moment of death.

* This atmosphere, we have reason to believe, consists of the vapour of oil of turpentine. We examined some of these specimens, which, after a simple injection with the solution of the acetate of alumine, were exposed to a current of air, and found them as hard as horn and somewhat distorted.—*Tr.*

## CHAPTER II.

### NATURAL MUMMIES.

WHILST man agitates and torments himself in employing all his activity to produce a feeble result, nature, all-powerful, by means of simple causes, produces wonderful effects. Man disputes with the rivers, the ocean's waves, some few acres of land, which he protects with great labour from their overwhelming influences. At the voice of nature, elements, until now foreign to each other, approximate, combine, and unite in the bosom of the earth, and suddenly throw up from the middle of the ocean vast isles and new continents. He has need of all his industry to make the sap circulate in a few etiolated plants; she, on the contrary, confers life and motion to all beings, or strikes them with torpor or death, according as she elevates or depresses the sun a few degrees in the horizon.

In order to preserve the bodies of his own image, man, stimulated by sentiments of religion, respect, or of love, mutilates in vain their inanimate spoils; in vain he penetrates with aromatics and preservative juices, remains, which putrefaction reclaims and seizes. Nature covers with a little snow the traveller who scales the mountain, then, after centuries, returns the body unaltered. She commands the winds to blow: the sands of the desert are agitated, and the soldiers of Cambyses, and the sol-

diers of Alexander, are dried in the dust; penetrating with some unknown bodies the entrails of the earth, she there preserves the generations which have preceded us.

Here is the art of embalming in its highest degree of perfection; here are mummies which we ought to desire to imitate. It must be acknowledged, that when the Egyptians and the Guanches transmitted to us their bodies in a state of preservation, which has been the admiration and astonishment of ages, they owed as much, at least, to the aid of nature, as to the perfection of their art, and the development of their industry. If, then, we wish to preserve the bodies of those who excited our admiration or our love, in place of despising the mummies[1] which nature presents us with, let us study them, let us seek with care, the cause of their preservation, and, by reasonable analyses, let us endeavour to penetrate the secret of her ways.

If this direction had been followed, convenient processes would doubtless have been discovered a long time ago; and it never would have been supposed possible to preserve a corpse with certainty, by stuffing it with sixty or eighty kinds of powdered aromatics. After such considerations, we, who have substituted an experimental for an empyrical method, and progressed from the known to the un-

[1] The reverend Father Kircher in his chapter on mummies, thinks that these bodies do not merit the name; here is what he says in his chapter iii, §. 2. "But these bodies, dried and preserved in the sands of Lybia, should not receive the name of *mummy*, because a mummy is, properly speaking, a body prepared after a special process." Such ideas have caused much empyricism, and have been most powerful obstacles to the progress of the art of embalming.

known, ought, to be consistent, to study natural mummies first.

Some have been formed by the general qualities of the air and earth, others, by purely local influences; in the first series, we include *the mummy of the sand, and those of avalanches; in the second, those discovered here and there in certain sepultures; in the convent of the Capuchins, near Palermo; in the caves of St. Michel, at Bordeaux; in the cemetery of the church of Saint Nicholas; the Museum; the cloister of the Carmes; the caves of the Jacobins and the Cordeliers, at Toulouse, &c.*

These last named mummies, the preservation of which is probably due to the particular properties of the soil in which they were deposited, have been, up to the present day, objects of vulgar curiosity, rather than of attentive examination.

Drs. Boucherie, Bermont, and Gaubert, have favoured me with some notes taken during a visit to the caves of St. Michel, at Bordeaux, (*August*, 1837.) I let them speak for themselves:

"The bodies exposed to view at Bordeaux, in the cavern situated beneath the tower of Saint Michel, were deposited there in 1793, nearly in the same state in which they appear at present, they came from the sepulchres of the church and the adjoining cemetery. A great number of bones, and the wreck of soft parts, dried and preserved like the whole bodies, form a layer of seventeen or eighteen feet, upon which are supported the inferior extremities of seventy subjects, arranged in a circle around the wall, and retained in a vertical position by the cords which bind them. Some of these, they say, had re-

mained in the earth many centuries, others from sixty to eighty years or more.

"During our visit, 25th August, 1837, we determined to examine with care the state of these bodies, those of the middle, where they had remained for more than forty years, and above all, we procured strips of skin and muscle, in order to examine them at leisure, and to submit them to some chemical re-agent, which might reveal to us the presence of the preservative element. We could not hope to collect any of the earth that had originally covered them, since they were superposed on remnants thrown into this place at the time they were enclosed here.

"After having furnished ourselves with a thermometer at 24° R., and a hygrometer at 34°, both in the open air, we descended thirty or forty steps, which conducted us to the cave. The coolness did not appear to us very striking, as it commonly is at this depth during the heat of the dog-star. Placing our instruments on the soil, we proceeded to examine the bodies.

"It is an extraordinary aspect, by lamp-light, offered by this circular space, the walls of which are tapistried by dead bodies all standing erect; the eye wanders from one to the other involuntarily, and we view the whole before confining ourselves to details. Although the most of them are in the attitude of the buried dead, some differences in size, in the position and expression of the physiognomy, produce a strange and confused impression. There is one point, however, where our regards were particularly attracted, where the heart is chilled and

troubled with deep emotion—here is beheld a miserable creature in a position violently contracted—the mouth open and horribly contracted, the inferior members strongly drawn to the body—the arms, one twisted by convulsions is thrown over the head, the other folded beneath the trunk, and fixed to the thigh by the nails, which are deeply implanted in the flesh; the forced inflexion of the whole body, gives the expression of ineffable pain, all announcing a violent death. Unfortunate wretch! had he died in this state, or rather, had he been buried alive, and assumed this position in the horrible agonies of awakening?

"The skin of all these mummies, of a more or less deep gray colour, dried and rather soft to the touch, gives the sensation of parchment slightly stretched upon the organs, dried, and of the consistence of amadou* or spunk; the articulations are stiff and inflexible; the chest, the abdomen, and the cranium, examined carefully, did not show any incision, any regular opening indicative of any trace of embalming, even the most imperfect. The different features of the face, still distinct among some of them, displayed a variety of physiognomy; two or three of them displayed the hair of the beard very well preserved, the teeth were healthy and covered with brilliant enamel. The upper and lower extremities entirely dried, and whole in many of the subjects, are provided with all the phalanges; the last, however, divested of its nail. On the body of the tallest figure is perceived enormous purses, with

* A sort of tinder made of agaric.—*Tr.*

evident traces of a double scrotal hernia. The skin raised and viewed on its interior surface, is tanned like the exterior; all traces of cellular tissue has disappeared; the muscles, separated from the skin, have the colour and consistence, and almost the internal structure of amadou. On introducing the hand into the chest, some rudiment of lung was found, a net work very similar to that of leaves deprived of their fleshy part; they might be taken for a mass of leaves dissected by the caterpillars, and rendered adherent by the threads and viscous fluid that these insects deposit. The intestines, also dried, are nearly in the same state.

"Such are the principal details which presented themselves in the course of our examination: at first sight, it appeared astonishing that these bodies, removed for more than forty years from the medium in which they were desiccated, should have experienced no sensible alteration in a cavern situated deeply under the earth, and surmounted by a structure like that of the tower of St. Michel. Let us return to our instruments, perhaps they will aid us in the explanation of the fact. After remaining an hour in this atmosphere, the thermometer passed from 24° to 18°, and the hygrometer, from 34° to 32°, which gives a difference for the first, of 6°, for the second of 8°, a very trifling difference, when compared to that of caves and other places in the same apparent position. This thermometrical and hygrometrical state of the air, always invariable, is, without doubt, one of the principal circumstances in maintaining the integrity of these mummies. To what cause, further, can be attributed this double

state of the air in the cavern? A slow fermentation, movements of latent decomposition in the enormous mass of animal remains which form the bottom of this recepticle, are they not the probable cause? We think so, and we leave with confidence this idea, to the meditation of philosophers. Our end was attained, we had proved facts, and collected some parcels of the remains to subject them to analysis; after different trials without result, some portions of skin and muscular tissue, placed in weakened hydrochloric acid, and treated by ebullition, were totally dissolved in this liquid, to which they communicated a deep brown colour. This liquor filtered and treated by the yellow cyanate of potash, yielded a very abundant blue precipitate; and the presence of iron was thus indicated, from whence we thought that the preservation of these bodies was owing to the presence of a compound of iron in the earth, where they had been deposited. But the human blood yields iron also; was it a portion of this element of our tissues that our experiments brought into play? A suit of comparative experiments upon the tissues of mummies, on the one hand, and of the same tissues dried in the sun of subjects recently dead, on the other hand, have evidently proved the excess of iron in the first. Analogous circumstances doubtless, have determined the preservation of the bodies found at Toulouse, at Palermo, &c. We regret not to be able to transmit the suit of experiments made by our learned friend, Dr. Bucherie; these will form the subject of ulterior researches."

The same phenomenon still occurs in different parts of our country, under a moderate temperature:

thus, about 1660, M. de La Visée and his domestic, having been assassinated at Paris, and interred on the place where the crime was committed, their bodies were discovered after the lapse of a year, whole and readily recognisable; a cloak even, lined with plush, had not suffered the least alteration.

The mummy of the avalanches, and all those, the preservation of which is due to a constant low temperature, retain the freshness and plumpness of the tissues for years and for centuries, if the conditions of the medium remain the same; but, under these circumstances, the action of cold exerts no other influence than the suspension of decomposition; for the moment it ceases, the tissues are rapidly exposed to the laws of inorganic chemistry.

In those cases, however, where the bodies exposed to cold are subjected to a dry and lively wind, a real mummification may occur, as in the following example:

There is upon the summit of the Great Saint Bernard, a sort of morgue (*dead house*) in which have been deposited, from time immemorial, the bodies of those unfortunate persons who have perished upon this mountain by cold, or the fall of avalanches.

The study of the circumstances of locality, and of temperature, in which this establishment is placed, may, to a certain degree, indicate the most favourable conditions for the long preservation of bodies. Here they show to travellers, bodies, which they assert have been sufficiently well preserved to be recognisable after the lapse of two or three years. A physician, whose quality as ancient prosector of the faculty of Medicine of Paris, rendered him curi-

ous to visit this part of the hospital in all its details, has verified with his own eyes all that travellers have written, and has transmitted to us the following observation:

The hospital of Saint Bernard, is, as is well known, the most elevated habitation in Europe, being 7,200 feet above the level of the sea. The temperature of this part of the globe is always very low, rarely above zero, even during summer. This extensive establishment is built upon the borders of a little lake, at the bottom of a little gorge; the principal mass of the building represents a long parallelogram placed in the direction of the gorge, so that its two principal faces, pierced with numerous windows, are sheltered from the wind by the rocks; whilst the two extremities, on the contrary, are exposed to all the violence of those which blow from one side of the gorge to the other. About fifty steps beyond this principal building, and a little out of a right line with it, is situated the *morgue*, a sort of square chamber, the walls of which, three or four feet thick, are constructed of good stone, and the arched roof of which is very solid. Two windows of about four feet square, are pierced in the direction of the breadth of the valley, directly facing each other, so that a perpetual current of cool air traverses the interior of the chamber. There is, further, but a single table in this morgue, upon which they place the bodies when first introduced; after a while they are arranged around the walls in an upright attitude. At the time of my passage of the Great Saint Bernard, (31*st August*, 1837,) there were several of these mummified bo-

dies along the walls of the chamber, but a greater number were entirely divested of flesh, and lie scattered about the earthy floor of the room. They informed me, that decomposition only took place when the bodies fell by accident to the ground; which was owing to the humidity occasioned by the snow, which occasionally entered with the currents of air through the windows of the morgue.* (Note communicated by Dr. Lenoir.)

The existence of the mummies of the sands, is attested by numerous travellers, and all the authors who have written on embalming mention them. They are every where found, where an arid and burning atmosphere deeply penetrates the masses of fine sand, easily agitated by the winds. In Egypt, for example, Herodotus frequently speaks of these bodies dried by the sun. Cambyses, on the authority of this author, suffered horrible effects from these sands, driven before the wind; he lost almost his whole army during his expedition to the temple of Jupiter Ammon.

Pere Kircher gives us an interesting description of these sand storms: "In the countries of Africa situated beyond the Nile, is a vast desert of sand,

* Early in September, 1833, I had an opportunity of inspecting the contents of the morgue of Saint Bernard. Among the group of bodies of every age and sex, we were particularly struck with two figures, one, that of a man, whose countenance was horridly contorted by the act of desiccation; each limb, and every muscle of the body, had assumed the expression of a wretch in purgatory. The other was that of a mother holding her infant to her bosom, the latter, with an imploring expression, looking up to the face of the mother, whom it appeared to have survived some time, as is generally the case when mother and child are frozen together—a greater power of forming animal heat existing in children.—*Tr.*

the immense waves of which appear in the boundless horizon like those of the sea. Agitated by the winds, these sands produce such frightful tempests, that they swallow up under their enormous masses, travellers, beasts of burden, and merchandise. Bodies thus engulfed, become desiccated after a series of years, both by the ardour of the sun's rays, and by virtue of the burning sand: this is the reason that some have asserted that mummies might be formed by natural causes only, &c.[1] Penicher, Clauderus, De Maillet, Rouelle Le Comte de Caylus, cite examples of the same nature. A whole

[1] The following is the passage of P. Kircher, of which we gave only a few passages in our citation.

"Est in Transpilana Africæ regoine, desertum ingens sabuli, arenarumque cumulis in immensum exporrectum, unde et sabulosi maris non immerito nomen obtinuit; hæ siquidem arenæ ventis concitatæ tam sævas subinde tempestates movent, ut arenis in clivos aggestis, turbinum violentia, et jumenta et viatores una cum mercibus suis, nulla evadendi spe relicta, vivos sepiliant. Refert Pomponius Mela de rupe qua dam in hoc deserto existente, austro consecrata, quæ simul atque vel manu tacta fuerit, austro mox provocato, Sævissimas procellas moveat, sabulo in tantum intumescente, ut pelagus undarum vorticibus, fluctuumque æstibus concitatum videraqueat. Hanc rupem dum olim sylli inconsultius adeunt sive occultiori naturæ impetu, sive magicis incantationum præstigiis, vento mox exoriente, et sabulosos cogente montes, ad unum omnes extincti ferunter. Est et in hoc deserto, ammonium oraculum et serapium, sphyngesque ingentes quarum aleæ usque ad caput, aleæ ex dimidio arena obrutæ, strabone teste, spectantur. Hoc itaque celeberrimum oraculum consulturus olim Alexander Magnus, dum pleno aleæ itineri se accingit, ad illud quidem incolumis pervenit, sed quos milites ex suo exercita non sabulosi pelagi turbines, hos æstus, sitisque confecisse traditur. Sed ut unde digressus revertar, in hoc sabuloso deserto dicunt non nulli mumias solius naturæ industria confici; dum aiunt, viatorum deserti tempestatibus extinctorum corpora tum solis tunc ferventissimæ hugus arenæ pinguioris virtute, longo tempore siccata, tostaque, in hunc statum degenerare. Sed tametsi subinde, in hoc Lybiæ deserto hugusmodi a sole exsiccata corpora reperiantur, illa tamen minime mumiæ discendæ sunt."

caravan, or some travellers, disappear under a mass of sand; years, centuries, pass by, then a new revolution in the disposition of these masses restores to the light of day, those bodies which a previous revolution had engulfed; blackened, dried, and lightened by the loss of all their fluids. In Mexico, Mr. Humboldt met with true mummies. Travellers have visited battlefields, situated on a soil deprived of rain, and in a burning atmosphere. They saw with astonishment, that these fields were covered with the dead bodies of Spaniards and Peruvians, dried and preserved for a long time. At the side of these phenomena which nature offers us, come the mummies of which Maillet speaks in his letters on Egypt.

"There has been discovered," says he, "recently, in this plain of mummies, a mode of burying hitherto unknown. At the extremity of this vast open country, and towards the mountains, which bound it on the west, have been discovered beds of carbon, on which are laid bodies clothed only with some linen, and covered with a mat, upon which rests the sands seven or eight feet in thickness. Nevertheless, it is to be observed, that these bodies, although they were not embalmed, or at least but slightly so, the same as those that they have neglected to enclose in cases, were none the less beyond the reach of corruption."

I promised to demonstrate the simple connection which exists between the products of nature, and those of human industry, to show that the first were the origin of the second. The facts which I have

just exposed, I think, place this proposition beyond a doubt.

The preservation of bodies among the Guanches, which is already a step advanced in the art, will form the subject of the following chapter.

## CHAPTER III.

### EMBALMING OF THE GUANCHES.

THE Guanches, with the Egyptians, are the only nation among whom embalming had become national, and there exists in the process and mode of preservation of both such striking analogy, that the study of the Guanch mummies is, probably, the surest means of arriving at some positive notions of their origin and relationship. To make ourselves understood in the subject which now occupies us, we ought to remark, that the details known of the mode of embalming among the Guanches, will enlighten and complete the descriptions that ancient authors have transmitted to us of the Egyptian processes: it is thus that it appears to us without a doubt, that their silence on desiccation in the act of mummification, is a simple omission on their part: that this desiccation was continued during the seventy days of preparation; that it constituted the principal part of the processes adopted; and that, because among the Guanches desiccation was placed in the first rank, if we are to credit the relations of authors. We see in this, one of the finest examples of the utility of the comparative study of the manners and usages of different nations: light is thrown on both by the comparison of facts.

The pains taken by the Guanches to evaporate the fluid parts of their dead bodies, is the cause

which determines us to place their mummies immediately after those of the deserts of Lybia; because their processes approach nearest to that of nature. The details which we are about to give, are extracted from the excellent work of M. Bory de Saint Vincent on the Fortunate Isles.

"The arts of the Guanches were not numerous, the most singular without doubt is that of embalming.

The Guanches preserved the remains of their relations in a scrupulous manner, and spared no pains to guarantee them from corruption. As a moral duty, each individual prepared for himself the skins of goats, in which his remains could be enveloped, and which might serve him for sepulture. These skins were often divested of their hair, at other times they permitted it to remain, when they placed indifferently the hairy side within or without. The processes to which they resorted to make perfect mummies, which they named *xaxos*, are nearly lost. Some writers have, nevertheless, left details on this subject, but perhaps they are not more exact than those which Herodotus has transmitted to us upon the embalming of the Egyptians.

With the Guanches, the embalmers were abject beings; men and women filled this employment respectively, for their sexes; they were well paid, but their touch was considered contamination; and all who were occupied in preparing the xaxos lived retired, solitary, and out of sight. It is, then, out of place, that Sprats has advanced the idea, that embalming was confined to a tribe of priests, who made a sacred mystery of it, and that the secret died with

the priests. There were several kinds of embalming, and several different employments for those who had charge of it. When they had need of the services of the embalmers, they carried the body to them to be preserved, and immediately retired. If the body belonged to persons capable of bearing the expenses, they extended it at first on a stone table; an operator then made an opening in the lower part of the belly with a sharpened flint, wrought into the form of a knife and called *tabona;* the intestines were withdrawn, which other operators afterwards washed and cleaned; they also washed the rest of the body, and particularly the delicate parts, as the eyes, interior of the mouth, the ears, and the nails, with fresh water saturated with salt. They filled the large cavities with aromatic plants; they then exposed the body to the hottest sun, or placed it in stoves, if the sun was not hot enough. During the exposition, they frequently endued the body with an ointment, composed of goats' grease, powder of odoriferous plants, pine bark, resin, tar, ponce stone, and other absorbing materials. Feuille thinks that these unctions were also made with a composition of butter, and desiccative and balsamic substances, among which are mentioned the resin of larch, and the leaves of pomegranate, which never possessed the property of preserving bodies.

On the fifteenth day the embalming should be completely terminated; the mummy should be dry and light; the relatives send for it and establish the most magnificent obsequies in their power. They sew up the body in several folds of the skin, which they had prepared when living, and they bind it

with straps, retained by running knots. The kings and the grandees were besides, placed in a case or coffin of a single piece, and hollowed out of the trunk of the juniper tree, the wood of which was held as incorruptible. They then finally, carried the xaxos, thus sown and encased, to inaccessible grottoes consecrated to this purpose.

Another less expensive mode of preserving the dead, consisted in drying them in the sun, after having introduced into the belly a corrosive liquor: this liquor eats into the interior parts, where the sun does not act sufficiently to prevent their corruption. Like the other xaxos, the relatives sowed them in skins and carried them to the grottoes.

These mummies, such as they are found at the present day, are dry and light; many have perfectly preserved their hair and beard, the nails are often wanting; the features of the face are distinct, but shrunken; the abdomen is contracted. In some, there exists no mark of incision, in others are observed the trace of a rather large opening on the flank. The xaxos are of a tanned colour, with generally an agreeable odour; exposed to the air, out of the sacks of goat skin, which are admirably preserved, they fall by degrees into dust; they are punctured in many places; surrounded by the chrysalides of flies, proceeding probably from maggots, deposited upon the body during its preparation: these larvæ and chrysalides, which could not be reproduced, are preserved whole and healthy like the mummies.

The Chevalier Scory says, that these mummies are two thousand years old: it is difficult to deter-

mine how long they have been preserved; but we shall see in the sequel that it has been certainly more than two thousand years since the Guanches embalmed. I willingly believe that, in the corrosive composition which they employed in the second kind of embalming, and probably in all cases, the Guanches made use of the juice of the spurge; they doubtless employed the species proper to their climate, which is acrid and milky; I have recognised whole pieces in the chest of a mummy, in which, nevertheless, there existed no traces of an incision. Leaves, also, it is said, have been taken from the body in a good state of preservation, and have been recognised as those of the laurel. During the exposure of the body to the sun, they extend the arms of the men along the side of the trunk, and for the most part crossing those of the women before the lower part of the abdomen. From time to time new catacombs are discovered in the Canary islands. In 1758, they found one at Palma; but the mummies were either very old, or badly embalmed, they soon fell into powder. At Fer, there was found on the tables where the xaxos had laid, the furniture which the deceased had used during life. In this island they wall up these caverns, to prevent them being used as retreats for birds of prey and for crows.

At the Canaries, they do not limit themselves always to placing the mummies in grottoes; they elevated special tombs to certain distinguished dead. These privileged dead, dressed in their garment, called tamareo, were placed upon elevated planks of pine wood, with the head turned towards the north; they afterwards constructed above, a monu-

ment of hard stone, pyramidal in form, and often very high. Many catacombs are known to exist in Teneriffe; the most celebrated is that of Baranco de Herque, between Arico and Guimar, in the Abona country: it was discovered during the time that Clarijo wrote his *Noticias*. He states that they there met with more than a thousand mummies, whilst in other cases only three or four hundred had been found at a time. From hence they brought the xaxos, which are in the cabinet of the King of Spain, and the two which M. de Chastenet Puysegur sent in 1776, to the Garden of Plants: one of them unfortunately wants the feet.

We abstain from all reflection on the recital which precedes. Their analogy to the Egyptian process will occur of itself to the mind of the reader, in the description which follows. Nevertheless, we ought to indicate a fact observed of two Guanch mummies; a fact omitted in the preceding description.

M. Jouannet, a modest and laborious investigator, has proved, that two Guanch mummies that were in his possession, had the eyes, nose, and mouth, filled with bitumen, like some of the Egyptian mummies. The skins which enveloped them were carefully closed, and nothing indicated that the bitumen was an addition posterior to embalming.

## CHAPTER IV.

### EMBALMING AMONG THE ANCIENT EGYPTIANS.

SINCE the ignorance we are in, relative to the language of this great nation, places it out of our power to know, of ourselves, the causes and processes for the preservation of dead bodies, let us follow the recital of ancient authors, let us endeavour to detect, not by the imagination, but by positive facts, by the study of invariable exterior conditions, the different data of the question of embalming among the Egyptians.

In the first place, if we make allowance for all that the successive perfection of the arts, luxury, or the love of distinction could add to simple preservation, we shall arrive, with Rouelle, to this conclusion, that the work of embalming is reduced to two essential parts: first, the drying of the body, that is to say, removing the fluids and grease which they contain; secondly, to protect the body thus prepared, from external humidity and contact of the air. We have already seen all the aid which they derived from their climate to fulfil the first condition: a detailed description will teach us what their industry enabled them to add to it. As to the second, the nature of their caverns powerfully contributed.

These vast cavities, says Pelletan, sheltered from the inundations of the Nile, have, without doubt,

originally furnished the materials for the monuments of Thebes, and the architects of the day thus hollowed out the tombs of families in elevating their palaces. Their whole surface, from the entrance, even to the deepest recesses of these dark excavations, are covered with sepultures and fresco paintings. Each framed subject forms so many little pictures which touch each other, and the figures of which are not more than two or three inches in height, so that the whole extent of these double walls, the development of which is incalculable, has been the object of minute labour. The sculptures are in bas-relief, and covered with equable tints, but lively, *and in very good preservation.* The points of rock unconnected with the work, have been covered with a composition perfectly solid, and so durable, that, as yet, *no other degradation is observable, than that produced by the efforts of some travellers to carry off fragments of it.* Perspective is always wanting in these pictures; the bodies are viewed in full, the faces in profile; but the design is pure and the proportions just; we find nothing to indicate ignorance in the artist; which presumes for the Egyptians, if not great perfection in the arts, at least a great popularity in their practice. The subject of these paintings are domestic scenes, and generally followed by a funeral procession; from whence it may be inferred, that they refer to the life of the man enclosed in each of the lateral niches. The temperature of the caverns is 20° R.

It appeared to us convenient thus to give a summary of the conditions of drying, and of the ulterior preservation, before presenting descriptions which

have been more or less accurately transmitted to us, of the part that man has had in this operation.

Herodotus, Diodorus Sicculus, and Porphyrus, who have written with the greatest detail on the funerals of the Egyptians, will afford us the first instructions.

Herodotus. Mourning and funerals are conducted after this manner: when a man of consideration dies, all the women of his house (*oiketes*) cover the head and even the face with mud; they leave the deceased in the house, girdle the middle of their bodies, bare the bosom, strike the breast, and overrun the city, accompanied by their relations. On the other side, the men also girdle themselves and strike their breasts; after this ceremony, they carry the body to the place where it is to be embalmed.

The following, after Diodorus Sicculus, (book 1st, vol. i. p. 102, §. xcii.) is the ceremony of sepulture among the Egyptians: "The relatives fix the day for the obsequies, in order that the judges, the relations, and friends of the dead may be present, and they characterize it by saying, he is going to pass the lake; afterwards the judges, to the number of more than forty arriving, they place themselves in the form of a semi-circle beyond the lake. A batteau approaches the shore, carrying those who have charge of this ceremony, and in which is a sailor, whom the Egyptians name in their language *Charon*. They say, further, that Orpheus having remarked this custom in his voyage in Egypt, took occasion from it to imagine the fable of hell, imitating a portion of these ceremonies, and adding to them others of his own invention. Before placing

in the batteau the coffin containing the body of the deceased, it is lawful for each one present to accuse him. If they prove that he has led a sinful life, the judges condemn him, and he is excluded from the place of his sepulture. If it appear that he has been unjustly accused, they punish the accuser with severity. If no accuser presents himself, or if the one who does so is known as a calumniator, the relatives, putting aside the signs of their grief, deliver an eulogium on the deceased without mentioning his birth, as is practised among the Grecians, because they considered all Egyptians equally noble. They enlarge on the manner in which he has been schooled and instructed from his childhood; upon his piety, justice, temperance, and his other virtues since he attained manhood, and they pray the Gods of hell to admit him into the dwelling of the pious. The people applauded and glorified the dead who were to pass all eternity in the abodes of the happy. If any one has a monument destined for his sepulture, his body is there deposited; if he has none, they construct a room in his house, and place the bier upright against the most solid part of the wall. They place in their houses those to whom sepulture has not been awarded, either on account of crimes, of which they are accused, or on account of the debts which they may have contracted; and it happens sometimes in the end that they obtain honourable sepulture, their children or descendants becoming rich, pay their debts or absolve them. Orpheus communicated to the Greeks these usages of the Egyptians, applied to hell. Homer, following in his steps, adorned his poetry with them: "Mercury,"

says he, "his wand in his hand, convoked the souls of the candidates." And further on: "They traversed the ocean, passed near Leucadia, entered by the gate of the sun, (*Heliopolis,*) the country of dreams, and soon attained the fields of Asphodelia, where inhabit the souls who are the images of death."

But to return to the recital of Herodotus. There are in Egypt, certain persons whom the law charges with embalming, and who make a profession of it. When a body is brought to them, they show the bearers models of the dead in wood. The most renowned represents, they say, *him whose name I am scrupulous to mention;* they show a second, which is inferior to the first, and which is not so costly; they again show a third of a lower price. They afterwards demand after which of the three models they wish the deceased to be embalmed. After agreeing about the price, the relatives retire; the embalmers work alone, and proceed as follows, in the most costly embalming. They first withdraw the brain through the nostrils, in part with a curved iron instrument, and in part by means of drugs, which they introduce into the head; they afterwards make an incision in the flank with a sharp Ethiopian stone.

The body being extended upon the earth, the scribe traces on the left flank the portion to be cut out. He who is charged with making the incision, cuts with an Ethiopian stone, as much as the law allows; which having done, he runs off with all his might, the assistants follow, throwing stones after him, loading him with imprecations, as if they

wished to put upon him this crime. They regard, indeed, with horror, whoever does violence to a body of the same nature as their own. Whoever wounds it, or in one word, whoever *offers it any harm.*" (*Diodorus*, book 1, t. i. p. 102.)

They withdraw the intestines through this opening, clean them, and pass them through palm wine, place them in a trunk; and among other things they do for the deceased, they take this trunk, and calling the sun to witness, one of the embalmers on the part of the dead, addresses that luminary in the following words, which Euphantus has translated from his vernacular tongue. "Sun, and ye too, Gods, who have given life to men, receive me, and grant that I may live with the eternal Gods; I have persisted all my life in the worship of those Gods, whom I hold from my fathers, I have ever honoured the Author of my being, I have killed no one, I have committed no breach of trust, I have done no other evil: if I have been guilty of any other fault during life, it was not on my own account, but for these things." The embalmer, in finishing these words, shows the trunk containing the intestines, and afterwards casts it into the river. As to the rest of the body, when it was pure, they embalmed it." (*Porphyr., De abstinentia ab esu animalium*, book 17, § 10, p. 329.)

Afterwards they fill the body with pure bruised myrrh, with canella and other perfumes, excepting incense; it is then sown up. When that is done they salt the body in covering it with *natrum* for seventy days. (Natrum, with the intention of carrying off, and drying the oily, lymphatic, and greasy

parts; but this ought to have been the first operation, for if they had commenced with filling the body with myrrh and aromatics, previous to salting it, the natrum, acting on the balsamic matters, and forming with their oils a soapy matter, very soluble and readily carried off by the lotions, would have destroyed the greater part of the aromatics. Besides, Diodorus does not mention natrum.) It is not permitted to let them remain longer in the salt. The seventy days elapsed, they wash the body and entirely envelope it in linen and cotton bandages, soaked with gum Arabic, *commi*, which the Egyptians used generally in place of glue.* The relatives now reclaim the body; they have made a wooden case of the human form, in which they enclose the corpse, and put it in a chamber destined for this purpose, standing erect against the wall. Such is the most magnificent method of embalming the dead. Those who wish to avoid the expense choose this other method; they fill syringes with an unctuous liquor which they obtain from the cedar; with this they inject the belly of the corpse without making any incision, and without withdrawing the intestines; when this liquor has been introduced into the fundament they cork it, in order to prevent its ejectment; the body is then salted for the prescribed time. The last day, they draw off from the body the injected liquor; it has such strength that it dissolves the ventricles and intestines, which come

* It is not improbable that the use of these gummy bandages gave origin to the new and improved method of bandaging fractured limbs—the bandages being first soaked in a solution of gum Arabic, or in a preparation of starch, called dextrine.—*Tr.*

away with the liquid. The natrum destroys the flesh, and there remains of the body, only the skin and bones. This operation finished, they return the body without doing anything further to it.

The third kind of embalming is only for the poorer classes of society. They inject the body with a fluid named *surmata;* they put the body into *natrum* for seventy days, and they afterwards return it to those who brought it.

As to ladies of quality, when they are dead, they are not immediately sent to the embalmers, any more than such as are beautiful or highly distinguished; these are reserved for three or four days after death. They take this precaution lest the embalmers might pollute the bodies confided to their care.

It is reported that one was surprised in the act, with a woman recently dead, and that on the accusation of one of his comrades. The preceding recitals have been the subject of numerous commentations, discussions, and researches. It is astonishing that Herodotus has omitted desiccation; but it naturally took place during the time consecrated to preparation. Some assert that the body was in the first place salted, and subsequently penetrated with resinous and balsamic substances, which, incorporating with the flesh, prevented putrefaction: others pretend that the body, after having been salted, was dried, and that it was not until after this desiccation that the resinous and balsamic substances were applied. A simple inspection of the mummies is sufficient to reject the first opinion. What union, indeed, could these last named matters have con-

tracted with the fluids of the tissues? and how can we conceive from thence, that bodies often filled with corrupted serosity, could have resisted the intestine effects of such active causes in producing decomposition?

M. Rouelle thought that the *natrum* was a fixed alkali, which acted after the manner of quick-lime, despoiling the bodies of their lymphatic and greasy fluids, leaving only the fibrous and solid parts. Thus viewing in this manner the Egyptian process, it removes an error into which Herodotus has fallen on the subject of the first class of embalming. It is there stated, that they filled the belly of the corpse with myrrh, canella, and other perfumes, except *incense*, and that afterwards they put it into the *natrum* and then washed it. But of what use would have been these resinous matters, with which the alkali of the *natrum* would soon form a soapy mass, which the lotions would have carried off, at least, in great part? It is much more reasonable to suppose that these balsamic and resinous substances were not applied to the bodies until after they were withdrawn from the *natrum*.

The same author points out another inaccuracy, in what Herodotus has taught us on the bandages of the mummies. Very few mummies, says he, are enveloped agreeably to the description of Herodotus, that is to say, the linen bandages are not glued together with gum alone, applied directly to the body when simply dried without any resinous substances. Such kind of embalming is the least costly, although Herodotus describes it as the richest and dearest. The mummy preserved in the cabinet of St. Gene-

vièvе, and the two which are in that of the Celestins, may throw some new light on this passage of Herodotus, and confirm my conjectures. These mummies have two kinds of bandages; the body and the limbs are each separately invested with linen bandages, endued with resin or bitumen, and they are so intimately united together that they form but one mass. This is doubtless the reason that some authors have believed that this thickness was only embalmed flesh. There are other linen bandages without any bituminous substance, which envelope the whole body; both the arms are crossed upon the stomach, and the legs are glued together; these mummies are swaddled in new bandages, or, if you please, by this last bandage, just as infants are swaddled; these bandages are yellow, particularly those of the mummy of the cabinet of Saint Geneviève, and are absolutely destitute of resinous substance. We may, then, readily conclude, that these bandages have been only simply invested with gum. It appears that Herodotus had forgotton to describe the use of the first bandage, employed to retain the resinous matter on the surface of the body, and having probably seen among the embalmers, or elsewhere, some bodies swaddled like infants, he only described the second bandage.

If we examine with attention, the mummy of Saint Geneviève, and those of the cabinet of the Celestins, it will be perceived that the second bandage is equally a suit of ordinary embalming; for the mummy of the Celestins, of which the first bandage has been removed, no doubt in order to see the process of embalming, has the bands of the first band-

age of a very clear and coarse linen: the bands of that of Saint Geneviève, on the contrary, are much finer, whilst the substances of the embalming of the two mummies are the same.

I am persuaded that mummies seldom come to us with the second bandage, and that the preservation of those of the mummies of the cabinet of Saint Geneviève, and of the Celestins, is only due to the state of the cases which hold them, or to the peculiar care of those who sent them.

In fine, Rouelle has analysed the substance of embalmings, and the result of the analysis made on six mummies gave him for two, amber, for the four others, Jew's pitch or pisasphaltum, a mixture, into the composition of which, Jew's pitch enters. Rouelle met with no traces of myrrh in any mummy. From these facts he arrives at the following conclusion: "Our experiments, then, furnish us with three materially different embalmings. The first, with Jew's pitch; the second, with a mixture of bitumen, and the liquor of cedar, or *cedria;* and the third, with that mixture, to which they have added resinous and very aromatic matters."

We confine ourselves to these reflections upon the processes described by the ancients, and given by them as those alone practised in Egypt.

We are going to cite some passages from the very remarkable memoir of M. Rouyer, from which it will be readily perceived that they were ignorant of several methods in use among these people. Nevertheless, it is just to give here some explanations which throw new light upon the sources which we

have reproduced; they are principally extracted from the memoir of the Count de Caylus.

The exhibition of models on the part of the embalmers, had reference to the richness of the work demanded, and to the expense of the chosen form. The first model, which Herodotus had scruples in naming, was probably the figure of some divinity, (*Isis.*) Herodotus does not mention the price, and it is probable, that Diodorus has made his valuations without being any too well acquainted with them. According to his estimation, the first cost one talent, (about nine hundred dollars of our money;) the second, twenty mina, (three hundred dollars;) the third, a trifle, (vague.) Diodorus continues in these terms: "The office of burying is a particular profession, which, like all others, has been learned from infancy. Those who exercise it, go to the relatives of the deceased with a scale or rate of charges, and request them to make a selection. Having agreed, they take the body and give it to the officers whose duty it is to prepare it."

In the head, which was sent by M. de Caylus, the skull had been actually pierced through the nostrils, and the bottom of the right orbit opened. As to perfume, the exception in favour of the incense is probably made out of respect to the divinity. He observed no trace of incision, nor were they at all necessary. The extreme dryness of the skin, and the solidity it acquires by the bitumen, renders such operation useless.

The Egyptians employed their natrum as we employ lime, to prepare and tan leather. Also kommi, or gum Arabic of Senegal. As respects bandages, they

had many kinds; whether as regards the quality of the linen, or the manner of arranging them, more simple or more complex. As many as a thousand ells of these narrow bands have been found on a single mummy.

Diodorus, after speaking of those who make the incision, adds: those who salt come afterwards: these officers are highly respected in Egypt; they hold commerce with the priests, and the entrance to sacred places is open to them, the same as to persons who are themselves sacred. They assemble around a corpse which has just been opened, and one of them introduces his hand through the incision into the body, and withdraws all the viscera, excepting the heart and kidneys, another, continues he, washes them in palm wine and odoriferous liquors; they afterwards anoint the body for thirty days with cedar, gum, myrrh, cinnamon, and other perfumes, which not only contributes to preserve the body in its integrity a very long time, but which also causes it to shed a very sweet odour. They then return to the relatives, the body restored to its original form, in such a manner that even the hair of the eyelids and eyebrows remain unruffled, and the corpse preserves its natural expression of countenance and personal bearing. Many Egyptian families, having, by this means, preserved a whole race of ancestors, experience an inexpressible consolation in thus beholding them in the same figure, and with the same physiognomy, as if they were still living.

As regards those who have been killed by a crocodile, or who have been drowned in the river, the

inhabitants of the city nearest to which the body has been cast ashore, are obliged to embalm it; to adjust it in the most magnificent manner, and deposit it in the sacred tombs. Neither the relatives or friends are permitted to touch these bodies; they are embalmed alone by the priests of the Nile, considering them as something above humanity.—(*Herodotus.*) Are these sacred tombs those of the God Apis? Were there places of sepulchre different from the caves and pyramids?

The expense and care required for the embalming of princes must have been immense, as may be conjectured by the following fact. A portion of mummy preserved in the cabinet of Saint Geneviève, merits all the eulogiums that could be given to an object of this kind. It consists of the foot, leg, and thigh of an infant two or three years old; the care with which this embalming was made, was known to those who presented it to the cabinet, for they had written upon the box which contained this precious relic of the art, *mummy of the little prince of Memphis.* This denomination has no other foundation, perhaps, than the nature of the work, and the sensible difference observed between this and other mummies. The surface of the flesh is black, and so smooth that it may be compared to a fine Chinese varnish; the flesh has not altogether preserved its softness, but all the thickness and plumpness peculiar to little children can be distinguished, as well as the articulations and all the little wrinkles of the fingers. The nails are perfectly preserved and well set on; they have neither colour nor gilding, although they appear to have been gilded. The

bandages do not appear to have been imbued with the same bitumens used for other mummies; the colour which they have acquired by the dried balsamic materials, as might be anticipated, resembles that of canella, although the odour, which is agreeable, has no analogy to that aromatic.

The bandages are fine, detached, and proportioned to the body which they cover; they are arranged with the greatest care and repeated a great number of times. Besides, the thigh bone, of which there is about four fingers breadth uncovered, has suffered very little alteration in its colour, nothing more than what the air alone might produce. Rouelle, with whom M. de Caylus visited this mummy, remarked, on piercing with a pin the sole of this foot, that the skin resembled stretched parchment, and was empty beneath—all of which proves a richer and more extensive preparation destined for princes. We may add to this conjecture, that the cases of touchstone, or of basalt, always expensive on account of their hardness, cases so rare that only three or four have been found, may be supposed to have been made only for princes, and even the more eminent of those.

We have not hesitated to include in this work the preceding observations, because they appeared to us necessary to rectify or complete the facts advanced by Herodotus, Diodorus Sicculus, Plutarch, Porphyrus, and many others. But the whole of these materials have need of new lights, drawn from researches made upon the spot. The scientific commission of Egypt felt the necessity of this, and several of its members applied themselves to personal

examinations of the pyramids and caverns; and one of them, M. Rouyer, in his memoir on Egyptian embalming, traces us a history nearly complete. The following are the most interesting details:

The art of embalming is totally unknown at the present day in those places which gave it birth, and it has remained buried in profound forgetfulness, since Egypt, which, long the home of the sciences and the arts, has been overrun and successively ravaged by barbarian nations, who have destroyed all its institutions, political and religious.

The historians, to whom we are indebted for all we know at the present time of the ancient wonders of Egypt, and who have written during the period when the Egyptians still possessed some of their customs, could alone transmit to us the ingenious secret of embalming; but their recitals prove, that they themselves possessed but an imperfect knowledge of it.

All the ancient authors agree, in saying that the Egyptians made use of various aromatics to embalm the dead; that they employed for the rich, myrrh, (the resin of a species of *Mimosa,*) aloes, (the extracto-resinous juice of the *Aloe perfoliata,*) canella, (bark of the *Laurus cinamomum,*) and the cassia lignea, (bark of the *Laurus cassia;*) and for the poor, the cedria, (the fluid resin of the *Pinus cedrus,*) bitumen, (*Bitumen judaicum,* derived from the Dead sea,) and natrum, (a mixture of the carbonate, sulphate, and muriate of soda.)

Although the recitals of Herodotus, and of Diodorus Sicculus, on embalming, are not very complete, and that some details appear inexact and improba-

ble, as several of the French investigators have observed, however, on placing in convenient order what Herodotus relates on this subject, we shall soon perceive that he has described in a few lines almost the whole theory of embalming. The Egyptian embalmers knew how to distinguish from the other viscera, the liver, the spleen, and the kidneys, which they did not disturb; they had discovered the means of withdrawing the brain from the interior of the cranium without destroying the bones of the latter; they knew the action of the alkalies upon animal matter, since the time was strictly limited that the body could remain in contact with these substances; they were not ignorant of the property of balsams, and resins to protect the bodies from the larvæ of insects and mites; they were likewise aware of the necessity of enveloping the dried and embalmed bodies, in order to protect them from humidity, which would interfere with their preservation. These people had established invariable rules and a certain method for the process of embalming. We remark, in effect, that the labour of those who were charged with embalming the dead, consisted in two principal operations, very distinct: the first, to subtract from the interior of the corpse all that might become a cause of corruption during the time allotted to dry it; the second, to secure the body from any cause that might subsequently occasion its destruction.

The odoriferous resins and bitumen not only preserved from destruction, but also kept at a distance, the worms and beetles which devour dead bodies. The embalmers, after having washed the bodies with that vineous liquor which Herodotus

and Diodorus call palm wine, and having filled them with odoriferous resins or bitumen, they placed them in stoves, where, by means of a convenient heat, these resinous substances united intimately with the bodies, and these arrive in very little time, to that state of perfect desiccation in which we find them at the present day. This operation, of which no historian has spoken, was, without doubt, the principal and most important of embalming.

The most noted grottoes and pyramids have been sacked by the Arabs. Also, in search of treasure, they have penetrated into the bosom of mountains, and descended into those vast and deep excavations, where they arrive only by long canals, with which some are encumbered. Here, in chambers, or species of pits, worked into the rock, are found millions of mummies, piled upon each other, which appear to have been arranged with a certain symmetry, although many are now found displaced and broken.

Near these deep pits, which served for a common sepulture for several families, we meet also with other smaller chambers, and some narrow cavities in form of niches, which were destined to hold one mummy only, or at most two. The grottoes of Thebes enclose a great number of mummies, better preserved than those in the caverns and pits of Saggârah. It is particularly, near the ruins of Thebes, in the interior of the mountains which extend from the entrance of the valley of the Tomb of Kings, to Medynet Abou, that I have seen many entire and well preserved mummies.

It would be impossible for me to estimate the pro-

digious number of those which I have found scattered and heaped in the sepulchral chambers, and in the multitude of caverns which exist in the interior of this mountain. I have developed and examined a great number of them, as much with the view of inquiring into their state, and examining the preparation, as with the hope of finding idols, papyrus, and other curious objects, that the most part of these mummies enclose beneath their envelopes. I have not remarked, what Maillet asserts, caverns specially destined to the sepulture of men, of women, and of infants; but I was surprised to find so few infant mummies in the tombs which I visited. These embalmed bodies, among which we meet with nearly an equal number of men and women, and which at first view appear to resemble each other, and to have been prepared in the same manner, differ, nevertheless, in the various substances which have been employed to embalm them, or in the arrangement and in the quality of the linen employed to envelope them.

The Count de Caylus, and the celebrated chemist, Rouelle, have supposed that all the cloths that enveloped the mummies were of cotton; I have found a great number of them which were enveloped in linen bandages, of a much finer tissue than those of cotton, which are commonly found around mummies prepared with less care. The mummies of birds, particularly those of the Ibis, are also enveloped with linen bandages. On examining with attention and in detail some of the mummies found in the tombs, I have distinguished two principal classes: those in which they have made, on the left

side above the groin, an incision about two and a half inches long, penetrating into the lower cavity of the belly; and those which have no incision whatever in any part of the body. In both classes, we find many mummies with the partition of the nose torn, and the ethmoidal bone entirely destroyed; but some of the last class have the spongy bones untouched, and the ethmoidal bone entire, which might make it appear that, sometimes the embalmers did not disturb the brain. The opening found in the side of most mummies, was doubtless made in all cases of select embalming, not only for the purpose of withdrawing the intestines, which are not found in any of these desiccated bodies, but also the better to clean the cavity of the belly, and to fill it with a greater quantity of aromatic and resinous substances, the volume of which contributed to preserve the body, at the same time that the strong odour of the resins kept off the insects and worms. This opening does not appear to me to have been sewn up, as Herodotus asserts; the borders have only been brought together, and are re tained so by desiccation.

1. Among the mummies with an incision in the left side, I distinguish those which have been desiccated by means of tanno-balsamic substances, and those that have been salted. The mummies that have been dried by means of astringent and balsamic substances, are filled as with a mixture of aromatic resins, and the others with asphaltum or pure bitumen.

Mummies filled with aromatic resins are of an olive colour; the skin is dry and flexible, like tanned

leather; it is rather contracted upon itself, and appears to form but one body with the fibres and the bones, the features of the face are recognizable, and appear to be the same as in the living state; the belly and chest are filled with a mixture of friable resins, soluble in part in spirits of wine: these resins possess no particular odour rendering them recognizable; but, thrown upon living coals, they shed a thick smoke and a strongly aromatic odour. These mummies are very dry, and easily unrolled and broken; they still preserve all their teeth, the hair of the head and eyebrows. Some of them have been gilded over the whole surface of the body; others are gilded only on the face, the natural parts, on the hands and on the feet; these gildings are common to a considerable number of mummies, which prevents me from partaking in the opinion of some travellers, who suppose that this kind of decoration was restricted to princes, and persons of a very distinguished rank.

These mummies which have been prepared with great care, are unalterable so long as they are retained in a dry place; but, unbound, and exposed to the air, they promptly attract moisture, and after a few days shed a disagreeable odour. Mummies filled with pure bitumen, are of a black colour; the skin is hard and shining, as if it had been covered with a varnish, the features of the face are not altered; the belly, breast, and head, are filled with a resinous substance, black, hard, and with but little odour. This matter, which I have taken from the interior of many mummies, has presented the same physical characters, and has given, by chemical ana-

lysis, the same results as the Jew's pitch of commerce. These sort of mummies, which are met with commonly enough in all caverns, are dry, heavy, without odour, difficult to unfold and to break. Almost all have the face, the natural parts, the hands, and the feet gilded; they appear to have been prepared with much care; they are very little susceptible of alteration, and do not attract the moisture of the air. The mummies with an incision in the left side, and which have been salted, are equally filled, the one with resinous substances, and the other with asphaltum. These two sorts differ but little from the preceding: the skin has also a blackish colour, but it is hard, smooth, and stretched like parchment; there is a space existing beneath it, and it is not glued against the bones; the resins and bitumen which have been injected into the belly and chest are less friable, and do not reserve any odour; the features of the face are somewhat altered, very little hair remains, which falls when touched. These two sorts of mummies exist in great numbers in all the caverns: when unwrapped and exposed to the air, they absorb moisture, and become covered with a light saline efflorescence, which I have ascertained to be sulphate of soda.

2. Amongst those mummies without an incision in the left side, nor in any other part of the body, and from which the intestines have been withdrawn from the fundament, I also distinguish two sorts; those which have been salted, and then filled with a bituminous matter less pure than that which historians and naturalists call *pisasphaltum*; and those which have been only salted.

and of his captains, remained several days without being embalmed, and that, nevertheless, when they went to visit it, it was found sound, without blemish, having even the complexion as fresh and florid as if he had been living, although he died of a continued fever: his appearance was so natural that the Egyptians and Chaldeans, who were charged to embalm him after their own manner, were at first afraid to approach him, thinking he might not be dead.

Such marvellous accounts are not sufficiently in harmony with the rigorous course which we have thus far followed, to induce us seriously to discuss them; we confine ourselves to the statement of each down to our own day, where well established facts will offer ample matter for reflection.

The Jewish people, who, like others, testified their respect for the dead, never admit the care of embalming the body as a common usage. Thus, Abraham purchased the field where Sarah was buried; Joseph had the body of his father magnificently embalmed; Moses only carried away the bones of Joseph; David praised the people of Gilead, for having buried with pomp Saul and his sons, &c. In most of these examples, no mention is made of embalming; nevertheless, the body of Jesus Christ was embalmed. The following is nearly the method: each sex took care of its dead; they, first of all, close the mouth and eyes of the expired person, afterwards they shaved, washed, and rubbed it with perfumes; they tied it with bands, and buried it in several cloths of very fine linen or woollen, and finally, they put it into the sepulchre. Cornelius Jansenius thinks that the myrrh and aloes

which they employed, had the virtue powerfully to resist putrefaction. It is useless to say that this opinion is without foundation; that the great quantities of aromatics which they consumed, was rather for pomp, than for the long preservation of the subject. They took no pains to dry the body; they did not disembarrass it of the intestines, and, in spite of all these odoriferous drugs, as Penicher justly remarks, decomposition must soon have revealed itself, as was testified by the body of Lazarus when resuscitated.

Neither did the Persians, probably, propose by embalming, any thing beyond a very limited preservation; the passage which we cited in the first chapter is in proof of this. Besides, this custom with them does not possess a general character. Cyrus, King of Persia, said to his children: "when I have ceased to live, place my body neither in silver, nor in gold, nor in any other coffin, but return it immediately to the earth, for how can it be more happily and more desirably disposed, than to be returned to that which produces and which nourishes most excellent things?" It will be perceived, that Cyrus, in forbidding that any care should be taken with his body, does not allude to embalming, which, of all other means, would have been the most efficient in preventing its elements from returning to the common mother. The Greeks and the Romans, among whom we have particularized some examples of embalming, practised it in a coarse and imperfect manner. The examination of their method would be here without interest. In order to recover some traces of this art, we must refer to De Bils,

Ruysch, Swammerdam, Clauderus, &c. They only boast of their astonishing success, without giving us the means of studying their methods. What we do know of them suffices only to make us doubt, as we have seen, the perfection of their processes. De Bils, of whom we have not yet spoken, had a cabinet which excited the admiration of visiters; he never revealed his secret, and he even shed an odour of aromatics through his anatomical rooms, in order to deceive observers. Clauderus, who suspected the deception, applied his moistened finger to one of the bodies, and carrying it to his lips recognised the taste of salts. He started from this fact to attempt numerous researches, and succeeded in forming different compounds, of which the preservative powers are, without doubt, exaggerated; we shall give the analysis of them hereafter.

De Rasière, ècuyer, sieur Dèsenclosses, published in 1727, a description of a cabinet, in which he preserved a hundred specimens; the following extract from his pamphlet presents several descriptions of subjects skilfully prepared; it is preceded by an engraving, representing the cabinet, of which he gives the description.

*Extract from the description of the cabinet of anatomy, of M. De Rasière, ècuyer, sieur Dèsenclosses*, 1727.

This cabinet is eighty feet long, by sixteen wide, the glass windows are double, and exposed to the south, with a good ceiling and boarded, which renders it very proper for the preservation of the curious pieces which it encloses, and which are more than one hundred in number, differently worked,

and arranged so that entire men are placed in the inferior departments, and the infants in the superior; all the fleshy pieces are enclosed in glass cases, and the skeletons in niches covered by a curtain. The whole so disposed, that the skeletons and muscular pieces are arranged alternatively. We see, also, entire carcases of men, so arranged, that the head, which is placed on the large bones, is crowned by the vertebræ, and the ribs are suspended above. This order, added to the quantity of paintings and gildings which embellish the cases and cornices, produces a very fine effect. The side which looks to the south, includes a great number of bottles of all sizes, and contains objects taken from the animal, vegetable, and mineral kingdoms.

The middle of the cabinet is occupied by numerous interesting objects. We first perceive a large glass case, which includes all the internal parts of man, and fetuses of all ages, and a microscope to view the circulation of the blood. Then appears a horse's skeleton, mounted by a skeleton cavalier, holding a sword in his hand; an air pump; an anatomical table, upon which is a corpse, and an anatomist in wax, standing before it, dissecting.

Among the pieces of the cabinet mentioned by M. De Rasière, the most remarkable are: *In the first glass case,* the preparation of Gotard's skeleton, in which are distinctly displayed the four hundred and fifty-six muscles. *Second case:* partial preparation of the eyes and the tongue, of the head, of the body, of the arms and legs. *Third case:* preparation of the muscles, arteries, veins, and nerves of the right side, and the skeleton of the left side. The *fifth*

*case* is a complete preparation, in which the skin and fat has only been removed, and all the parts beneath separated. We here observe, first, the ascending aorta, which carries the blood to all the superior parts; second, the carotid arteries, which supply the head; third, the temporal arteries; fourth, the radial arteries (pulse;) fifth, the crural arteries, and an infinity of others even to the most delicate branches. The veins are filled with a black fluid. Sixth, preparation of the veins of the arm. Seventh, jugular veins; eighth, veins of the foot; ninth, vena cava ascendens. *Eighth case:* a subject resembling accurately a mummy or embalmed body, such as are brought from Egypt. All the flesh is covered by the skin, through which may be seen the veins and arteries filled with congealed and coloured wax. The hair of the head, the beard, and all the hair of the body, as well as the nails, are still attached to it. *The eleventh glass case* encloses the body of Nicholas Lefort, aged eighty-three years, a native of Douai, in Flanders: this subject is peculiarly tasteful, every thing being naturally arranged; the external muscles are divested of their fat, and all the arteries, veins, and nerves, which ramify upon the muscles, skin, &c., have been preserved, which renders this preparation as curious as it was difficult of execution. *Twelfth case:* preparation of the nerves.

But the author is silent regarding the manner of making these preparations. Let us endeavour to find in the writings of the time, a description of processes capable of producing such results.

Penicher, in his chapter fifth, (of embalming according to the moderns,) gives us the composition

and properties of balm. "It is composed," says he, "of different mixtures, both fluid and solid, calculated to arrest putrefaction, either by the aromatic virtues of sulphur and volatile salts, medicaments which enter into its composition, or by a strong bitter principle which consists in very penetrating particles, the property of which is to consume and attenuate the crude matters, which disposes and hastens the body to corruption; or by remedies, inheriting a quantity of particles which dissipate and absorb all putrescent moisture, or by their viscosity agglutinating the parts which ferment and rarify too readily; or, finally, by their astringency, which, fixing these same parts, prevents the resolution of all."

It is easy to perceive, by the explanations which precede, that the embalmers themselves possess no very clear ideas of the success which they obtained. The nomenclature which we give below, will justify the doubt we have expressed.

The powders, which constitute the base of the balm, are made of all parts of the plants which fulfil the indications so confusedly announced. Such were the roots of *angelica, imperatoria, galanga, acorus, carolina, caryophillata, gentian, enula campana, valerian, Florentine iris, flambe, calamus aromaticus, ginger, pyrethrum, cyperus, dictamus, rose wood, sassafras, guiacum, juniper, box wood, citron bark, oranges, canella, cassia lignea, tan, nutmeg, mace, cloves, cubebs, spicknard, colocynth, bay-berries, juniper-berries, and myrtle-berries, gall-nuts, cypress, anis-seed, cumin-seed, fennel-seed, coriander-seed, car damon-seed, long, white, and black pepper, rue-leaves,*

*thyme, absynth, savin, horehound, mugwort, laurel, mint, myrtle, calomint, balm, balmgentle, marjorum, rosemary, sage, summer savory, wild-thyme, penny-royal, mountain-mint, hyssop, nepeta, basilic, scordium, flowers of saffron, roses, pale and red, stœchas, centaury, melilot, chamomile, germander, chamœpitys, hypericum, caraway-seed, dill-seed, lavender.*

Many gums and resins entered into the composition of balm, such as *resin, Burgundy pitch, ship-pitch, gum elemi, assafœtida, aloes, myrrh, galbanum, acacia, tucamahaca, benzoin, styrax calamite, fluid styrax, turpentine, camphor, cedria, all the* species of balm; *wood of aloes, tartar, potash, from the lees of wine, civet, castor, musk, ambergris, labdanum, Jew's pitch, asphaltum, pisasphaltum, slacked-lime, plaster, sulphur, common salt, rock-salt, saltpetre, alum, amber, &c.*

The article of compound drugs, is not less extensive, such as the tincture of *musk, ambergris, civet, benzoin, styrax, aloes, myrrh.* The distilled oils and essences of the plants which we have named,—spirits of wine, distilled myrrh, aloes, and amber,—is excellent for the preservation of the fetus.

The salt of Clauderus has also enjoyed a great reputation; the following is its composition: Dissolve one pound of common salt with a pound of oil of vitriol in a crucible, apply a cover closely luted, and distil it gradually in a sand bath; you may pour off a spirit very excellent for a lotion; in the bottom of the crucible will remain a caput mortuum, which should be dissolved according to art, and after evaporation, you will have the salt so much esteemed by the author. We may add here the brine, which is

described in the collections of Charles de Maetz, (chap. 100, et 194; and chap. 23 of the book entitled *Chemia Rationalis*, and also in the work of Blanchard,) they advise that after a corpse has been emptied and cleaned of its excretions, it be placed in a leaden coffin, and there macerated in a sufficient quantity of pure oil of turpentine, and after some days of maceration, to wash it with spirits of wine to remove the odour, then sprinkle it with a strong tincture of myrrh and aloes, which they call *balsamum mortuorum*, and that it be finally dried in the sun.

I shall not now enter into the endless discussions upon the different species of salts, which some boast of for embalming, whilst others consider them injurious to the preservation of bodies. I abstain also, from speaking of lime, to which, however, wonders have been attributed: thus it was lime which preserved the body of *Afra:* and in the year 1523, under the pontificat of Adrian VI., the body of Saint Thomas, the Apostle, was likewise found towards the Gulf of Coromandel, endued, and covered with a cement made of lime and urine; the bones were very white, and along side of him the spear of his lance, a part of the cane which had served him during his journey, and an earthen vase which had been sprinkled with his blood. Notwithstanding these remarkable examples, if they are true, the authors who relate them give no importance to the processes to which we owe them, they even complain of the sordid views of those, who, in order to augment the mass of matters, do not hesitate to mix thereto plas-

ter, ashes, &c. We give the description of some of these mixtures composed of the substances which we have enumerated.

### 1.—*Balsamic Wine.*

℞. Good red wine, 8 pints.

| | |
|---|---|
| Cloves, roses, citron bark, colocynth, *a.a.** | 2 ʒ. |
| Styrax, benzoin, *a.a.* | 1 ʒ. |

Reduce these drugs to a coarse powder, macerate for a few hours in wine, and boil slightly.

*Usages.*—Lotion for the interior parts of the body; and to disinfect the chamber during the operation.

### 2.—*Compound Brandy.*

℞. Absynth leaves, great centaury, rhue, sage, marjory, mugwort, thyme, *a.a.* 4 handsfull.

| | |
|---|---|
| Colocynth, | 2 ʒ. |
| Styrax, calamite, benzoin, *a.a.* | 3 ʒ. |
| Pepper, ginger, *a.a.* | 2 ʒ. |

Macerate in a sea-bath for twenty-four hours, in fifteen pints of best brandy, with as much distilled vinegar.

### 3.—*Vinegar for washing the head, the breast, the belly, and for injections.*

| | |
|---|---|
| ℞. White and black pepper, ginger, *a.a.* | ½ ℔. |
| Colocynth, | 3 ʒ. |
| Absynth, centaury, hypericum, *a.a.* | 4 ʒ. |

Reduce to a coarse powder, and macerate in forty pints of rose-vinegar; then strain for use.

* *a.a.* of each.

4.—*Another.*

℞. Absynth, five or six handsfull.

| | |
|---|---|
| Colocynth apples, | 30. |
| Alum, common salt, *a.a.* | 1 ℔. |
| Concentrated vinegar, | 14 *pts.* |

Let it boil a little, and add two pints of brandy; better than the preceding.

The embalmer ought to have several large sponges; about four pounds of tow to dry the blood and absorb the powders; cotton for the mouth, nose, and ears; coarse brush for rubbing the exterior of the body with the liniment. The artist should have, besides, two ells of cere-cloth, which he can prepare for himself after one of the following formulæ:

1.—*Cere-cloth.*

| | |
|---|---|
| ℞. New wax, | 12 ℔. |
| Fluid styrax, oil of turpentine, *a.a.* | 1 ℔. |

Melt and mix them over a slow fire, then draw the linen through it frequently so as to impregnate both sides.

2.—*Another.*

| | |
|---|---|
| ℞. Yellow wax, | 25 ℔. |
| Turpentine, colophane,* resin, *a.a.* | 3 ℔. |
| Ship-pitch, | 2½ ℔. |
| Verdegris, | 1 ℔. |
| Incense, fluid styrax, *a.a.* | 2 ℔. |
| Oil of spike, | 1½ ℔. |

Melt, and mix the whole with two pounds of mutton suet, and plunge the linen in it as before.

* Colophane, a species of resin, used by violinists to rub their cat-gut strings.—*Tr.*

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3.—*Another.*

℞. New wax, 4 ℔.
Resin of pine, turpentine, *a.a.* 8 ℔.
Gum Arabic, 8 ʒ.

Melt, and soak as before.

4.—*Another.*

℞. Turpentine, 3 ℔.
Wax, 15 ℔.

Mix it with a sufficient quantity of oil to make a cerate.

1.—*Mixture for soaking the linens, the chemise, the coiffure, and the bandages.*

℞. New wax, 20 ℔.
Venice turpentine, gum elemi, *a.a.* 2 ℔.
Powdered florence iris, 4 ℔.
Styrax, calamite, benzoin, *a.a.* 6 ʒ.
Myrrh, aloes, *a.a.* 3 ʒ.
Balsam of Peru, oil of absynth, *q. s.*

Melt the wax and the gum, add the balsam, and then the powdered aromatics for use.

2.—*Another.*

℞ New wax, 12 ℔.
Common resin, 2 ℔.
Venice turpentine, 1 ℔.
Gum elemi, 4 ʒ.

3.—*Another.*

℞. White wax, 6 ℔.
Oil of nutmegs, distilled oil of lavender, citron bark, oranges, *a.a.* 2 ʒ.

The following are some formulæ of liniment, or fluid balsam, proper to rub the corpse both internally and externally.

### 1.—*Liniment.*

Dissolve two ounces of true balsam into two pints of spirit of wine.

### 2.—*Another Liniment.*

℞. Turpentine, oil of spike, *a.a.* 2 ℔.
Gum elemi, fluid styrax, *a.a.* 4 ʒ.
Oil of laurel, 3 ℔.

### 3.—*Another.*

℞. Fluid styrax, 6 ʒ.
Balsam of Peru, 2 ʒ.
Oil of mace, ½ ʒ.
Rosewood, 1 ʒ.

### 4.—*Another Liniment.*

℞. Oil of rosemary, rosewood, *a.a.* 3 ʒ.
Cloves, 1½ ʒ.
Absynth, origan, *a.a.* 1 ʒ.

### 5.—*Another.*

℞. Venice turpentine, 3 ℔.
Gum elemi, 4 ʒ.
Oil of hypericum, ½ ℔.
Balsam of Peru, (f. S. A.) 2 ʒ.

### 6.—*Another.*

℞. Venice turpentine, 6 ʒ.
Gum elemi, 3 ʒ.
Fluid styrax, 2 ʒ.
Calamite, benzoin, *a.a.* 1 ʒ.
Oil of spike, Muscat roses, nutmeg, distilled cloves, *a.a.* ½ ʒ.
Musk, ½ ʒ.
Civet, 1 ʒ.

The embalmer ought to furnish himself with silk ribands, of a black, violet, or white colour, according to the subject which he has to embalm, in order to tie the sheet by the two extremities, as well as a quarter of taffeta of one of the said colours to envelope the box containing the heart; further, five fathoms of cord to tie the corpse enveloped in cere-cloth. A coffin of lead in a coffin of wood. A barrel for the intestines. Bandages soaked in the liniment to bandage the body.

The following powder, as well as those which come after, are models which will serve according to the prudence of the embalmer for the cavities, for the parts sacrificed, and to form a crust around the body, or to be mixed with the adhesive plaster.

### 1.—*Balsamic Powder.*

℞. Angelica root, calamus, Florentine iris, flag, imperatoria, carolina, cypress, ginger, enula-campana, aristolochia, gentiana, valeriana, rosewood, spicknard, colocynth, *a.a.* ½ ℔.

Anis-seed, fennel, cumin, coriander, pepper, (white, black, and long,) cardomine, cypress, gall-nuts, citron-bark, oranges, juniper-wood, laurel, chamomile flowers, melilot, centaury, lavender, roses, *a.a.* 1 ℔.

Rhue leaves, absynth, mint, calamint, savin, thyme, marjory, balm, balmgentle, rosemary, sage, horehound, pennyroyal, origan, hyssop, laurel, myrtle, *a.a.* 2 ℔.

Tan passed through a seive, 4 ℔.

Canella, styrax, nutmeg, aloes, myrrh, benzoin, cloves, dittany, *a.a.* 4 ℥.

Reduce to a powder those which ought to be powdered, and then strain them through a seive; but for the canella, and others of that class, they must be beaten and employed separately.

Baltazar Timaeus added salt and incense to his powder.

### 2.—*Another Powder.*

℞. Select myrrh, 4 lb.
Bastard saffron, styrax, calamite, cloves, *a.a.* 2 lb.
Cabalin aloes, 5 lb.
Dried rosemary leaves, 2 lb.
Incense, 1 lb.
Laurel leaves, red roses, *a.a.* ½ lb.

### 3.—*Another.*

℞. Common absynth, southern wood, lavender, rosemary, laurel, *a.a.* 6 handsful.
Sage, marjory, basalic, origan, thyme, great savory, hyssop, chamomile, *a.a.* 3 handsful.
Flor. iris-root, 4 lb.
Santal citron, aloes-wood, ½ lb.
Canella, cloves, juniperberry sassafras, *a.a.* 1 lb.
Flower of roses, aloes, myrrh, incense, styrax, benzoin, *a.a.* 2 lb.
Rosewood, 3 lb.
Salt, 4 lb.

Make a powder, and reserve the oil of spike for the unction.

### 4.—*Another Powder.*

Two measures of best spirits of wine to anoint and bathe all the cavities; after which, rub all the

parts with turpentine, then stuff them with the following powder:

℞. Rosemary, laurel, hyssop, absynth, mint, rhue, sage, wild thyme, pennyroyal, origan, scordium, flowers of rosemary, roses, lavender, chamomile, stoechas, spicknard, *a.a.* 2 handsful.
Carraway and fennel seed, *a.a.* ½ ℔.
Gentain root, angelica, cloves, valerian, *a.a.* 1 ℔.
Reduce to powder and add:
Aloes, mastic, incense, *a.a.* 2 ℔.
Myrrh, ½ ℔.
Benzoin, styrax, labdanum, canella, cloves, nutmeg, mace, saffron, *a.a.* 1 ℥.
Mummy, 2½ ℥.
Reduce to powder in a mortar.

### 5.—*Another Powder.*

℞. Absynth, lavender, marjory, rosemary, thyme, balmgentle, cypress, mint, sage, balm, dill, origan, pennyroyal, red roses, *a.a.* 8 ℥.
Calamus, cyperus, gentian, Flor. iris, rosewood, *a.a.* 5 ℥.
Benzoin, styrax, aloes, myrrh, *a.a.* 6 ℥.
Nutmeg, cloves, *a.a.* 4 ℥.
Reduce to a fine powder.

### *Powder and Mixture.*

Take a sufficient quantity of salt, and as much alum, to be mixed with myrrh, aloes, absynth, canella, cumin, cloves, mountain mint, pepper, and other aromatics; reduce to powder, sprinkling it

with a little vinegar; then fill the body with it, rubbing with melted wax; then place the corpse in a leaden coffin. (*Formula of P. Bellon.*)

Penicher, who has furnished these different formulæ, will trace in the following pages the means of applying them.

There are many methods of embalming. The first, which is derived from the sacred scriptures, did not prevent the body from soon undergoing a change, since they neglected to remove the viscera, which cause corruption.

The second is that in which they confined their operations to emptying and cleaning the cavities which contain the intestines, the brain, and other noble parts, filling them afterwards with powdered aromatics, with tow and cotton.

The most common, and the most perfect which was practised, is the third; which consists in making incisions in all parts of the body, as we shall treat of further in the sequel.

We may add here a fourth mode, which regards only thin and fleshless bodies; it requires that the fat and flesh be removed, so that the skin and bones only remain. This method was not unknown to the Egyptians; and I have several times practised it, but the operation is laborious, and requires a skilful surgeon.

And finally, there is a last method of embalming the body, which is performed by making small openings in several parts of the body, under the armpits, the groins, and the anus, according to the ancient usage of the Egyptians. In order to commence this important operation, it is necessary, in the first place,

that the surgeon who has the honour to be employed to embalm a king or some sovereign prince, under the orders of his first physician, in the presence of the crown officers, makes with a bistoury several gashes in the soles of the feet, in order to prove, by this operation, that the subject whose body he is about to open is really dead; which is a much more certain method than the unctions formerly used in similar cases, to recall the animal spirits, which they suspected of being only stupified. He will afterwards make a long incision, from the superior part of the sternum, to facilitate the examination of the contents of the chest, and to investigate the cause of disease and death, in order that a faithful written report may be made in concert with the physicians and surgeons of the king. All the parts contained in this cavity must be removed; he will afterwards descend to the lower belly and examine all their contents, which he will remove for that purpose, taking away every thing disposed to corruption. The parts which ought to be removed, are, among others, the throat, comprehending the trachea and œsophagus, the tongue, the eyes, the lungs, the heart, which will be divested of its pericardium, to be embalmed separately, as in ordinary cases; the stomach, the liver, the spleen, the kidneys, the intestines, the brain, the membranes, the fat, the blood, the serum, the sponges, and other matters which have served during the operation; put all these things in a barrel, to be carried to the place of destination. I know that some authors recommend the extirpation of the sexual organs of both sexes; but, besides that this would be to disfigure the body of

a man, these parts may be preserved as well as others, and we owe respect to the instruments which have given us being. The surgeon having emptied these cavities, ought to work at the head, of which he will saw the cranium in the same manner as for anatomical demonstrations; and after he shall have examined and taken out the brain, the apothecary must carefully wash the cavity with aromatic wine and alcohol, and then fill it with the powder he will have prepared, and with cotton and tow soaked in some fluid balsam, in such a manner that there will be several layers of these stoupes and powder applied one above the other; after which replace the bones of the cranium and sew up the skin. He will then rub the head all over with one of the liquid balms, and bathe the face frequently with the same; envelope the head in a deep cap, which must be waxed; and after having insinuated into the nose, the mouth, the orbits of the eyes, and into the ears, cotton, soaked in liquid balm, the oils of nutmeg and cloves, he will labour at the abdomen, which must be washed in the same aromatic wine and alcohol, and rubbed with some of the aforesaid balms, and, finally, stuffed abundantly with powder and tow, until all these matters, distributed one above the other, will form the natural size and appearance of the abdomen, which must be sown up. The surgeon will take care that sections be made in the veins and arteries, in order to divest them of blood and humidity, which will be observed regarding the arms, thighs, legs, feet, heels, and other parts, as the back, shoulders, and buttocks, turning the corpse for this purpose, face towards the table; in these

thick and fleshy places, the incisions must be long, deep, and numerous, penetrating even to the bone; and when the large vessels have been opened and purged of their blood, the pharmacien will fill all these spaces with the powder, and then sew them up with a needle and thread, after having sprinkled and bathed them in aromatic wine and alcohol; for it is necessary to take care and foment incessantly these parts; absorb from them, if possible, all humidity, and dry them with a sponge, previous to rubbing them with liquid balm, or one of the liniments, and fill them with the stoupes and said powders. Finally, the whole must be sowed up very neatly, so that the body may not be disfigured; for the same reason the face ought not to be incised, and we ought to endeavour so to preserve the features that they may be easily recognised, as I have recently witnessed on the opening of the coffin of a bishop, who was embalmed more than fifty years ago, and whose countenance was not in the least disfigured. For this reason, the artist will make use of fine powders, of aloes, myrrh, and others; as regards the body, he will rub and anoint it with the liniment which he will have prepared, adding thereto the powder, which he will make into a paste. And it is necessary to remark, that in proportion as he finishes the embalming of each part, the surgeon ought to bandage it with bandages of linen soaked in the liniment, so that they will resemble a species of corset, and in form of the letter x; let them make several convolutions one upon the other, to keep the parts of the body compact, and prevent the aromatics escaping from the cavities filled with them;

these bandages should commence with the neck and finish with the feet and hands; they must be long and broad for the body, thighs, legs, and arms, but narrow and short for the fingers. This done, put on the chemise, washed as already recommended; ornament the subject with the exterior marks of dignity which were possessed during life time, and wrap it in a linen cloth soaked in liniment, which will serve as an adhesive plaster, which must be tied by the two extremities with a riband; above which, envelope it with the cere-cloth, which should be very closely bound with a cord. Finally, deposit the body in the coffin, the intervals of which must be filled with what remains of the powder, if there be any, or with parcels of dried aromatic herbs; close it and solder it with the utmost exactitude. Place on the outside a plate of copper, or some other durable metal, upon which has been engraved some appropriate inscription, to serve as a memento to posterity. The coffin must be placed in another of wood, which may be covered, if desirable, with a mortuary cloth.

This work being accomplished, we next come to the heart, which, as I have already stated, is separately embalmed. Supposing, then, that it has been removed from its place, divested of its pericardium, and both its ventricles opened, frequently washed with spirits of wine, and well cleaned of clotted blood, and of all other impurities that may be attached to it, and having allowed it to soak during the preceding operations in spirits of wine, or in distilled oil of turpentine, the apothecary now takes this viscera thus prepared; he fills the ventricles

with powdered aloes, myrrh, benzoin, and styrax; he may even rub it with oil, or essence of nutmeg, cloves, and canella, as also with the tinctures of ambergris, musk, and civet; he will then arrange it in perfumed cotton, so as to make it contain the powders, which, with the oils, will form a paste, and he will place it in a little sack of cere-cloth, perfumed with some of the above named essences, with which also he will rub the box in which it is to be enclosed, both internally and externally, solder it carefully and envelope it in taffeta of a certain colour, which must be equally soaked and rubbed with essences or tinctures, and tied with ribands of the same colour; the violet colour is the most appropriate for ecclesiastics.

I remember having embalmed the heart of an Abbé of quality who had led an exemplary life: the odour which it exhaled was so *sweet and agreeable, that it perfumed for several months the choir of the convent des Dames Religieuses, where it was deposited.*

The body and the heart being thus embalmed, it only remains to speak of the viscera, the lungs, and the brain, &c.

Blancardus teaches us the method of embalming separately all these parts; but, for myself, I do not attempt it; when they are embalmed, and it is desired to place them in a barrel in this state, it is still requisite to have recourse to spirits of wine, of the best quality; our brandy and aromatic wines are not strong enough. In order the more easily to clean these viscera, they must be opened lengthwise, incisions must be made in the lungs, the spleen, the uterus, and the other contents of the cavities; cleaned

of blood, serosity, and other foreign matter, which would cause them to putrefy in a little time; then washed with strong spirits of wine, having been previously washed in other liquors, and then arranged in a barrel, so that the powder first covers the bottom, placing a portion of the viscera on this first layer, and afterwards a second bed of powder; and continue thus to place the viscera and the powders alternatively, and by layers, until the barrel be nearly full, taking care that the last layer consists of this prepared powder, which must not be spared on this occasion. This barrel, which ought to be made of lead, should be placed in a second of wood, which must be accurately headed and pitched. (One wooden barrel only, was used for Henry III., King of France.)

Nevertheless, with all the precautions that could be taken to preserve these parts, in employing quantities of spirits of wine, aromatic powders, and other proper drugs, I have strong doubts that they would soon corrupt, and even before they could arrive at the place destined for their sepulture. Finally, when the body is to be publicly exposed on the bed where it died, the face should be washed with spirits of wine, and with true balm, refreshing it frequently; but when it is necessary to expose it on a bed of parade to remain several days, it is commonly sufficient to mould it in wax, and to show only its external figure, during the time that the body is upon the bed embalmed in a coffin. But, when the body itself of the deceased is exposed, it is necessary, in the first place, to paint and powder the hair or wig with a fine powder of pleasant odour;

shave the beard, if there be any, fill the mouth with powder and cotton, to elevate and protrude the cheeks, to which may be applied a little rouge, as well as to the lips; if the natural eyes have been removed, replace them with artificial eyes; force perfumed cotton up the nostrils; the nose may be refreshed with a linen cloth liberally endued with true balm, during the time that the subject is withdrawn from public view; thus, the mouth, and generally all the parts that ought to be seen, will be in their natural state, to the end that they may be the more readily recognised. For this reason, there ought not to be made any scarifications, as it is expressly remarked in the library of Herodotus. "Each part," says he, "is so perfectly preserved, that the hair of the eyebrows and eyelids, and even all the form of the body so well retain their appearance, that the figure and natural disposition is known with facility."

But, for all other subjects, those which are to be transported, you will deviate as little as possible from the following prescriptions. After having emptied the cranium by means of a large trepan opening made in the back part of the head; having removed the viscera, the throat, the membranes; scarified the fleshy parts, and having purged them of blood and other serosities, the corpse should be placed in one of the lotions, or in one of the brines described in chapter fifth, the materials of which are to be chosen according to the place and season of the year; and, after some days of maceration, the subject being well drained, insinuate into the cavity

of the cranium new melted wax; after which, replace the piece of cranium removed by the trephine; sew up the skin, and fill likewise the chest and abdomen with melted wax, and sew them up; afterwards fill the scarifications with such powders, aromatics, or herbs, as the country affords; bandage the body accurately with linen bandages, endued with one of the above mentioned liniments, or, in the absence of these, with turpentine, or with the tincture of myrrh and aloes, rubbing them on the body with coarse brushes; afterwards place the body (as was done with the bodies of Alexander and Agesilaus,) in a coffin filled with good honey, so that it may be surrounded on all sides, and penetrated within and without; and after having placed this well soldered coffin in another of wood, which must be well pitched, transport it to its place of destination. There it must be washed with spirits of wine before being exposed to the public.

A fairer specimen of embalming could not be chosen, than that which was made of Madame la Dauphine, by M. Riqueur, apothecary to the king and to this princess, assisted by his oldest son, apothecary to the king in survivorship. This embalming was executed with all the disinterestedness, ability, and prudence that could be desired, in the presence of M. D'Aquin, then first physician to the king; of M. Fagon, first physician to the late queen, and now first physician to the king; of M. Petit, first physician to Monseigneur le Dauphine; and M. Moreau, first physician to the late Madame la Dauphine; of M. Felix, first surgeon to the king; of M.

Clèmint, master surgeon of Paris, and accoucheur of the said princess. M. Dionis, his first surgeon, operated, assisted by Baillet, ordinary surgeon, and by another ordinary surgeon: Madam, the Dutchesse d'Arpajon, lady of honour; Madame la Marechall de Rochefort, lady of the bed-chamber; and many other ladies. M. Riqueur had the kindness, knowing that I was interested in such operations, to communicate his method to me.

*Description of the balm which was made for Madame la Dauphine.*

| | |
|---|---|
| ℞. Florence iris root, | 3 ℔. |
| Rush, | 1½ ℔. |
| Bohemian angelica root, ginger, aromatic calamus, aristolochia, *a.a.* | 1 ℔. |
| Imperatoria, gentian, valerian, *a.a.* | ½ ℔. |
| Balmgentle leaves, basilic, *a.a.* | 1½ ℔. |
| Savory, sage, thyme, *a.a.* | 1 ℔. |
| Hyssop, laurel, myrrh, marjory, origan, rhue, *a.a.* | ½ ℔. |
| Southern wood, absynth, mint, calamint, wild thyme, odoriferous rush, scordium, *a.a.* | 4 ℥. |
| Orange flowers, | 1½ ℔. |
| Lavender, | 4 ℥. |
| Rosemary, | 1 ℔. |
| Coriander seed, | 2½ ℔. |
| Cardamum seed, | 1 ℔. |
| Cumin, carraway, *a.a.* | 4 ℥. |
| Fruit, and seeds of the juniper, | 1 ℔. |
| Cloves, | 1½ ℔. |
| Nutmeg, | 1 ℔. |

| | |
|---|---|
| White pepper, | 4 ʒ. |
| Dried oranges, | 3 ℔. |
| Cedar wood, | 3 ℔. |
| Santal citron, roses, *a.a.* | 2 ℔. |
| Citron and orange peal, canella, *a.a.* | ½ ℔. |
| Styrax, calamite, benzoin, olibanum, *a.a.* | 1½ ℔. |
| Myrrh, | 2½ ℔. |
| Sandarac, | ½ ℔. |
| Aloes, | 4 ℔. |
| Spirits of wine, | 4 ℔. |
| Salt, | 4 ʒ. |
| Venice turpentine, | 3 ℔. |
| Fluid styrax, | 2 ℔. |
| Balsam of copaiba, | ½ ℔. |
| Balsam of Peru, | 2 ʒ. |
| Cere-cloth. | |

The heart, after having been emptied, washed with spirits of wine and dried, was placed in a glass vessel with this liquor; and this same organ, having been filled with a balm made of canella, cloves, myrrh, styrax, and benzoin, was put into a sack of cere-cloth of its own shape, which was again enclosed in a box of lead, cordiform, which was immediately soldered, to be presented to Madame la Duchesse d'Arpajon, who placed it in the hands of Monseigneur, the Bishop of Meaux, first almoner of the late Madame la Duchesse, who deposited it subsequently in the Val-de-Grace. The opening of the body was made most accurately by M. Dionis, her first surgeon. M. Riqueur filled all the cavities with stoupes and powdered balm. Incisions were made along the arms as far down as the hands; these

were supplied with aromatic powder, after expressing all the blood and washing with spirits of wine; the same operation was repeated on the thighs, which were incised in different places down to the feet, and all was neatly sewed up. A coarse brush was used to rub the body with a hot liquid balm, made of turpentine, styrax, and the balsams of copaiba and Peru, as already prescribed. Each part was enveloped in bandages soaked in spirits of wine, placing as much as possible of the said aromatic powder between the body and the bandages. The body was dressed in a chemise and a religious tunic, and surrounded with other marks of a particular devotion, such as a little chain of iron, at the end of which was a cross, which the princess kept in a trunk which she had brought with her from Bavaria. The body was then enveloped in cere-cloth and compactly tied, in order to be placed in a leaden coffin; at the bottom and throughout which, there was four fingers depth of the said balm in powder. This coffin, being well soldered, was enclosed in another of wood, all the vacant spaces having been filled with dried aromatic herbs. The entrails, after being well prepared, were placed in a leaden coffin, with a great quantity of the same aromatic powders, which, being well soldered, was enclosed in a barrel of wood."

We shall have occasion again to recur to this mode of preparation; observing only, that a subject thus mutilated, slashed, and stuffed, has more the resemblance of prepared meat than an embalmed body; that the sentiment which led to a recourse to

embalming, ought to create a deep horror for the mutilation of a body which it was desirable to possess in all its integrity; that, in fine, the operation of embalming thus practised is more cruel for the feelings, than the natural destruction and dissolution of the parts.

## CHAPTER VI.

### ART OF EMBALMING IN OUR OWN DAYS, PREVIOUS TO MY DISCOVERIES.

ORGANIC chemistry has made great progress since the commencement of the present century, and the facts upon which it is constituted have been sufficiently known and accurately studied, to elevate it to the rank of an exact science. Numerous applications have been made, with immense advantage to the arts and sciences; but the great light it has shed in such numerous directions, has but feebly enlightened the art of embalming, and we will say, with M. Pelletan, that we cannot but be astonished to observe, that the same processes are continued in our day which were only predicated on the description of Herodotus upon points evidently defective, and that without any kind of discernment or analysis, in a manner entirely routine. No regard has been taken to the enormous difference which the dissimilitude of exterior conditions must establish between our practices and those of the Egyptians. It is, nevertheless, an art thus constituted, which will invoke the aid of three learned professions. It was, indeed, a grave subject of discussion to determine, whether the physician, the surgeon, or the apothecary, ought to take precedence in the honours of this operation. A conciliatory spirit once arose in one of these disputes; after long consideration and mature

examination, it was concluded, that the three professions rendered such services in these circumstances, that they should march in a line, and that they ought, in consequence, to render each other aid and support in a common cause. Nevertheless, judging from the great incisions, perforations, the flesh hacked and stuffed with perfumes, the arbiter would have been justified in deciding that the hog-butcher possessed superior claims to any of his competitors for practising embalming. We shall be convinced, in reading the following notice, that the pretensions which we claim in favour of an honest artist, are neither ridiculous nor extravagant.

M. Boudet, charged with the embalming of the senators, gives us a faithful account of the method which he followed to preserve the magnates of the empire.

There was prepared for this operation :—

1. A powder composed of tan, decrepitated salt, quinquina, canella, and other astringent and aromatic substances, Jew's pitch, benzoin, &c.; the whole mixed and reduced to a fine powder, and sprinkled with essential oils: the tan forms one-half the weight, the salt one-fourth.

2. Alcohol saturated with camphor.

3. Camphorated vinegar, with spirits of camphor.

4. A varnish, composed of the balsam of Peru, and balsam of copaiba, fluid styrax, oil of nutmeg, lavender, and thyme, &c.

5. Alcohol saturated with hyper-oxygenated muriate of mercury.

The whole being prepared, the cavities are opened with large incisions, and the viscera extracted; a

crucial incision is made in the integuments of the cranium, the skull sawn circularly, and the brain removed; the intestinal tube is to be opened its whole length, and numerous deep incisions made in it; the whole to be washed repeatedly; after expressing them, wash them again in camphorated vinegar, and again with camphorated alcohol. All the internal parts thus prepared and rolled in the compound powder, are ready to be replaced. Numerous incisions are then to be made on the internal surfaces of the great cavities, following the direction of the muscles; wash all the parts and express them well; to which must succeed lotions of vinegar and camphorated alcohol; afterwards apply with a small brush, the alcoholic solution of corrosive sublimate to all the incisions; it produces much heat, the muscles become bleached, and the surface is promptly dried. This done, a layer of varnish must be applied to all the internal incisions, filling them with the powder; the varnish is also applied to all the internal surfaces of the cavities, also a layer of the powder which will adhere to the varnish; each viscera is then to be replaced in its proper position, adding as much of the powder as is necessary to fill the vacant spaces, and sew up the integuments, taking care to varnish and powder the internal surface of those which are contiguous to the bones. All the cavities being closed, varnish the external incisions and fill them with powder; varnish also the whole surface of the skin, and apply a layer of powder which will adhere generally. To the corpse thus embalmed, apply to every part, including the face, methodical bandages, which will

produce a general pressure and cover all the surface; varnish the first bandage, and apply a layer of powder; and finally, a second bandage, which must also be varnished; when the body is deposited in a leaden coffin, and all the spaces filled with compound powder, solder on the lid, and the operation is finished.[1]

It will be perceived that, in this method, the access of air is, as much as possible, opposed; but this precaution is illusory, since in place of drying the body, it has been filled with powders which are real hygrometers, and which only absorb humidity to become themselves loaded with it: that indispensable condition to all perfect preservation was here wanting, *completely to desiccate the body*, still preserving it afterwards from all humidity and access of air; adding further, that many of these substances neutralize each other.

M. Pelletan, who furnishes us with the preceding criticism, proposes to rectify the method after the data which we derive from those of the Egyptians, of Clauderus, and the researches of Rouelle. Consequently, we must proceed in the following manner: remove all the viscera, sew up carefully the integuments, plunge the body for several weeks, in a weak solution of sub-carbonate of soda, after having filled

[1] It is astonishing that M. Boudet, charged with the embalming of the senators of the empire, did not think of profiting by the discoveries of the illustrious Chaussier, in order to simplify a method so ridiculously empirical; for, between his processes and the thousand formulæ of Penicher, the difference is not very great; it is the same accumulation of powders, resins, balms, essences, &c. He had, notwithstanding, a good example to follow in anticipation of a better, which was the embalming of Colonel Morland.

all the cavities with it; wash the corpse freely, and soak it for some days in an aluminous bath, to remove all the alkaline particles; expose it afterwards to the air, or in a stove, to produce desiccation, taking care to fill all the cavities with tow, and with resinous and aromatic matters, so as to preserve the form; desiccation once completed, varnish with care the whole surface of the body, and envelope it in a double bandage, impregnated, and covered with the same varnish. This method, which approaches nearly that of the Egyptians, would secure, without doubt, a perfect preservation, provided the body be placed in a situation exempt from all humidity, and the temperature of which is not variable.

We should acknowledge the justice of these observations, and thank M. Pelletan for having substituted an accurate and rational proceeding for blind and thoughtless practices. The operation, nevertheless, as proposed by the professor, still exacts numerous mutilations. The inconvenience and inutility of so many efforts to preserve the body of our own kind, was, besides, long experienced by many spirited writers; which is proved by the eagerness with which they took advantage of the discoveries of Chaussier, respecting the properties of corrosive sublimate applied to embalming. By his researches it was proved, that this salt preserved animal matters soaked in its aqueous solution; that it produced this effect by an intimate combination with animal matter; in fine, that this matter saturated with corrosive sublimate, passed so quickly into a state of desiccation, that it was necessary to moderate it, to prevent the horny hardening of the

soft parts. Parts thus prepared, are rigid, hard, grayish, and preserved at the same time from putrefaction and insects. No time was lost to profit by this property of the deuto-chloride of mercury, to apply it to the preservation of whole bodies. It was, in fine, the last method of embalming practised previously to my own, and held as very superior to that of the ancients. We shall collect here, some observations cited as remarkable examples, and as proofs of the excellence of the process. It will remain for us afterwards to appreciate its merits. Let us first see the facts.

*First fact, (A.) Preparation made by Beclard.*

M. Beclard, chief of the anatomical works at the School of Medicine, was charged with the preservation of the body of a young man thirty years of age, who died of a hectic fever. The relatives desired to place the body in a glass case, and *requested, above all, that it should not be opened.* In spite of the disadvantage of this last restriction, M. Beclard succeeded in this operation by the following process: *the intestines were withdrawn, opened, and cleaned in a portion of their length, by a little hole made in the abdomen.* He penetrated the chest by means of *two incisions*, under the armpits; through which water was injected; *a small hole* was also made in the cranium; the blood of the abdominal and cutaneous veins was, as much as possible, expressed out, a mercurial solution was injected into the trachea, and the salt in substance introduced into all the cavities; the corpse was then soaked in a bath saturated with corrosive sublimate. During

the first month it appeared to offer some signs of putrefaction; it was then thought necessary to introduce an instrument into the abdomen by the aid of which the *peritoneum was incised* at different points, M. Beclard having already remarked, that those parts situated beneath the serous membranes, escaped the action of the sublimate: the body was returned to the bath; some scarifications were made beneath those points of the skin which appeared greenish; the epidermis of the soles of the feet also protected the subjacent parts; this was removed; finally, after two months sojourn in the sublimated bath, the body being withdrawn during a hot and dry season, became desiccated in a few days. It was preserved for a year enclosed in a box, without exhaling any odour, or without any sign of alteration. The skin is of a leaden gray colour, and the features of the face are deformed by the emaciation of the lips and cheeks.

*Second fact, (B.) Preservation of the body of Colonel Morland.*

In one of the German campaigns, M. le Baron Larrey was charged with the direction of the preservation of the body of the brave Colonel Morland, who received a mortal wound in one of the most brilliant charges. M. Ribes aided him in this preparation.[1] They at first removed all the viscera through an incision made in a line with the crest of the right ilium, and in cutting the attachments of

[1] We ought to render homage to the zeal and noble devotion which enabled the celebrated Larrey to surmount all the difficulties of his position to preserve the body of a companion in arms.

the diaphragm, and the canals which pass through the superior opening of the chest, the crown of the trephine applied to the posterior part of the cranium permitted the brain to be cleaned out by repeated injections. The eye was opened by bursting its globe. Having introduced the powdered sublimate into all the cavities, those of the face were plugged in order to prevent emaciation; the features were protected by graduated compresses and methodical bandages; the whole body was itself enveloped in several cloths, and placed in a barrel of super-saturated solution of corrosive sublimate; in this state the whole was forwarded to Paris. At the end of some months the barrel was opened; the body was found well preserved; on exposure to the air it dried quickly; care was taken to fill all the cavities with stoupes; the membranes of the eye, which had retired to the bottom of the orbit, were replaced by eyes of enamel; the hair, the eyelids, and the mustaches were preserved; *the features were recognisable*, and the body varnished carefully, and dressed in the usual clothes, produced a soft and melancholy illusion in those who had known this excellent officer. Now that several years have passed, the body of Colonel Morland, placed in a glass case in the library of M. Larrey, offers no sign of alteration, exhales no odour, and remains *perfectly recognisable*, although the skin looks *brown, and as if tanned*, and *all the cellular membrane appears to have disappeared*, so that the form of the muscles may be perceived through the dried integuments.

*Remarks on observing Colonel Morland's body.*—We have seen the body of Colonel Morland, and we

can comprehend that persons who have known him, and who have seen him dressed, may carry the illusion so far as to recognise some of his features. But, as for ourselves, it appeared to us impossible that a corpse, the white skin of which had become brown and tanned, of which all the cellular tissue had disappeared, and the general aspect of which is that of a rigid membrane glued to the bones, and some few dried fleshy fasciculi, should preserve a great likeness to the subject of which it affords only some wrecks. We confine ourselves here to the indication of the exaggeration of this fact in particular; we shall touch upon this subject again in our general remarks.

### *Third fact, (C.) Preservation of a young girl of ten years.*

M. Boudet, apothecary, was requested by a mother to prepare the body of a daughter who had died at the age of ten years, in such a manner that she could continually enjoy the sight of her.

A bust had been made of the infant, and they had taken care to choose, at the moment of death, eyes of enamel perfectly resembling her own. M. Boudet, untrammelled in his operation, which was performed at his own house, commenced by removing the viscera, by the aid of incisions skilfully managed. He extracted the brain through the occiput. The eyes were taken out and replaced by a plug; all the cavities were immediately filled with a dry stoupe, and the openings closed with accurate sutures. During these various preparations, the body had been plunged in a bath of pure alcohol, then into an al-

cohol bath containing a little sublimate. All being thus disposed of, the body was placed in a bath of distilled water, saturated with the sublimate, and in which still soaked some parcels filled with this salt. The body remained three months in this solution; forty pounds of the sublimate were consumed; much of the mild muriate was precipitated; even a portion of the mercury was revivified; but it is *necessary to observe* that the vase in which he operated *was of lead*, which should occasion the decomposition, and augment the consummation of the sublimate. At the end of three months the body was withdrawn from the bath, in order to proceed to the desiccation; it was suspended by bands in order to avoid deforming it, and to let it drain: care was taken to elevate the walls of the cavities with new stoupes, when they appeared to be deformed; the eyelids and the lips were kept closed with English taffeta. When the desiccation was completed, artificial eyes were put in, some features of the face were changed, and particularly the upper lip. A skilful artist modelled them in wax imitating the bust, which served him as a model; the skin being observed of a gray colour, it was coloured with paint; the hair, perfectly preserved, was very natural; finally, this infant, clothed in its ordinary dress, and enclosed in a glass case, presents a perfect resemblance, and causes an extraordinary illusion.

*Remarks on these three observations.*—Let us first remark that the substitution of this process for all those that had previously been employed, is a great progress. Indeed, in place of a multitude of drugs, endowed with properties either opposite or unknown,

a single substance, studied with care, and of determined properties, is placed in contact with the tissues, which become modified according to the wishes of the embalmer. A charlatanism thus becomes a scientific operation, since a method which preserves bodies, better or worse, takes the place of others, which, far from preserving from corruption, often accelerates it. Nevertheless, we must say, that embalming with sublimate is still far from perfection, and, not to speak here of the inconvenience resulting from the three cited observations, it will be observed that the incisions and mutilations exist still in this process; that they are necessary to it, since, in spite of the *wishes of the family*, Professor Beclard was obliged to multiply them, in order to arrest the progress of decomposition. Many months are requisite for the perfect completion of the work, which renders it impossible to recur to it under many circumstances. The action of the sublimate, which combines with the gelatine, and gives rise to an imputresible compound, protected from the ravages of insects, deforms the organs to such a degree, however, that the colour and general aspect of the body are changed. This deformation is so great in the third observation, that it was necessary to reform several organs: *the upper lip was so damaged, that a skilful artist was obliged to reform it in wax, as well as several other features of the face, in imitating the bust, which served as a model; the skin being of a gray colour, it was coloured with paint*, &c.

These imperfections would of course be of less importance in the preparation of anatomical parts; but, to preserve the body of a person who was dear

to us, they are serious, and leave a painful impression.

But to return to our exposition.

*Fourth fact, (D.) Proces-verbal of the embalming of the body of Louis XVIII., King of France.*

Extract from the procès-verbaux of the opening and embalming of the late King Louis XVIII.—*(General Repertory of Anatomy, Physiology, and Pathology, Vol.* 8, p. 36, *in* 4*to.*, 1829.*)*

*Proces-verbal of the embalming*, p. 40.

This day, 17th September, 1824, immediately after the opening of the body of the late King Louis XVIII., and conformably to the instructions given us by M., the Marquis de Brèzè, grand master of the ceremonies of France, we, the undersigned, proceeded to the embalming, after the following manner:

1st. The heart of the late king, after having been washed and macerated for four or five hours in an alcoholic solution of the deuto-chloride of mercury or corrosive sublimate, and having been filled and surrounded with choice aromatics, was enclosed in a leaden box, bearing an inscription indicative of the precious object which it contained.

2d. The viscera of the three great cavities of the body, after having been incised, washed, and macerated six hours in the above-named solution, were penetrated, filled, and surrounded with aromatics, and enclosed in a leaden barrel, bearing an inscription indicative of the parts it contained.

3d. The totality of the surface of the body, and the surfaces of the great cavities, were successively washed with a solution of the chloride of the oxide of

sodium, and with the alcoholic solution of the deutochloride of mercury.

4th. The fleshy parts, as well of the trunk as of the limbs, were extensively and deeply incised, and afterwards washed with the above named solutions.

5th. The surfaces of the body, of the cavities, and of the incisions, were supplied with several applications of spirit varnish.

6th. All the cavities were filled with powders, formed of various species of aromatics and resins.

7th. These cavities were closed by bringing their borders together, sustained by numerous sutures.

8th. The limbs, the pelvis, the abdomen, the chest, the neck, and the head, were successively surrounded with bandages, methodically applied.

9th. The whole surface of the body thus enveloped, was covered with many layers of varnish.

10th. Upon this varnish were applied bandages of gum diachilon.

11th. Over the bandages of diachilon, other bandages of varnished taffeta were applied.

12th. Finally, a last layer of bandages was applied over the varnished taffeta.

13th. The embalming terminated, the head of the late king was covered with a cap, his body with a chemise, his arms and breast with a vest, with sleeves made of white silk; the whole with a sheet of batiste.

It was in this state that the body of the king was returned to M. Brèzè, to be deposited in the coffin

which was to enclose his mortal remains at Saint Dennis.

Signed, Portal, Alibert, Dupuytren, Fabre, Distel, Thèvenot, Portal, (for Ribes,) Auvity, Breschet, Mura, Moreau, Bardenat, Vesque, Dalmas, Delagenerraye.

Here the process followed, although analogous in many respects to the preceding, differs from them, however, in the addition of numerous drugs, and in the rapidity of the preparation; the following nearly, in all respects, the same, will furnish matter for reflection.

*Fifth and last fact,* (*E.*) *Notice of the process of embalming, adopted for the body of L. D. C. D.*

Before exposing the details of this embalming, we ought to remark, that various reasons compelled us to modify, in different points, the plan which we had traced out for ourselves, after reading those authors who have written on this subject; thus, the family had earnestly desired that no part of the body should be abstracted, wishing that the coffin should contain the entire remains of L. D. C. D., their relation. On the other hand, it was necessary to preserve his features and physiognomy, in order that his body might be recognised on its arrival to his family, who inhabit England. Finally, that which, above all, prevented us pursuing a surer and more rational mode of operation, was the particular circumstances of the case, allowing us only one sitting to accomplish the embalming.

However this be, we shall now describe the pro-

cess which was followed, leaving for another article, which will appear immediately, the modifications that may be introduced to diminish the difficulty and expense, and, if possible, render the result more certain.

1. *Necroscopy.*—The process to be followed even in this early stage of the operation, is not a matter of indifference; all the external parts having to retain their natural form, great care was necessary in abstracting the viscera.

In order to secure this end, without, at the same time neglecting the examination of the organs, the following plan was adopted:

*a.* An incision, commencing at the symphysis of the chin, following the mesial line divided all the integuments and muscles down to the symphysis pubis.

*b.* The sternum sawn through the middle permitted the hand to be introduced into the cavity without destroying any part of the thoracic walls.

*c.* All the organs, from the tongue to the bladder and rectum, carefully detached, were withdrawn through this opening. (The result of the necroscopy was published in the third part of the *Bulletin Clinique*, p. 79.)

*d.* The eyes were extracted with precaution.

*e.* The integuments of the head were divided transversely, from one mastoid apophysis to the other, and turned down before and behind to the extent of three inches; it was in this space, where, by the aid of two sections by the saw, one vertical, the other horizontal from behind forwards, we were enabled to raise a segment of the cranium which al-

lowed of the extraction of the brain, the medulla oblongata being cut off as low down as possible.

2. *Desiccation of the corpse.*—This first operation over, the corpse was, as much as possible, disembarrassed of the fluids which it contained, whether in the great cavities, or in the cephalo-rachidien canal. Then, by the aid of precious aromatics, and absorbing powders, frequently renewed, the tissues were divested of their humidity.

3. *Maceration of the viscera.*—After the examination of these, they were freely washed in a saline solution, and then macerated for two hours in a concentrated solution of alum, hydrochlorate of soda, and chloride of sodium, (Gannal's liquor,) and finally, they were submitted for several hours more to the action of a concentrated solution of the deuto-chloride of mercury.

4. *Maceration of the corpse.*—All the parts having been conveniently detached, alcoholic injections were made into the vessels of the limbs, and into the rachidien canal; and immediately after each of these partial injections, others were made, consisting of the deuto-chloride of mercury, which were retained in the arteries by ligature, and in the canal by a cork. Similar injections were also used for various regions which are abundantly supplied with cellular tissue.

The members and the trunk, both internally and externally, were sprinkled with a concentrated alcoholic solution of the deuto-chloride of mercury, and enveloped for several hours with stoupes and compresses steeped in this liquid. Finally, in order that no part should be deprived of the conservative

action of the corrosive sublimate, the mouth, the nasal fossæ, the orbits, and the auditory passages, were filled with little bags of this substance in powder; and by means of profound and numerous incisions, the same was introduced in the muscles of the limbs and back, &c. (These incisions, narrow at the surface, extended deeply, and in various directions in the subjacent tissues.)

5. All the viscera were replaced in the great cavities formed by the union of the thorax and abdomen.

This part of the operation was made with extreme minuteness; the organs cut into pieces about the size of the fist, were separately dried in balsamic powders, then supplied abundantly with chloride of lime, and surrounded with stoupes steeped in the alcoholic solution of the sublimate; each package, thus constituted, was invested in two plates of lead, and placed in the cavity of the thorax; aromatic powders, chloride of lime, and stoupes, steeped in the sublimate, separated the different layers.

The heart, (for the satisfaction of the relatives,) was left entire, and replaced in its natural position, after having been subjected to the same preparations. The cranium was filled with the same substances employed for the preservation of each organ.

6. The segment raised on a level with the lambdoidal suture, the integuments are to be united by methodical suture, and the same is to be done for the abdomen and thorax.

The seam on the scalp was not visible, because it was covered by the hair, with which the head

was yet abundantly covered. The trunk was not deformed.

7. *Application of the bandages.*—Previously to applying the bandages, a coat of varnish is given to the whole body, with the exception of the face, and immediately upon this varnish are placed layers of lead; it is then only, that methodical bandages are made to cover all the parts, from the fingers and toes to the head; each turn of bandage was fixed by a point of suture, then covered again with another layer of varnish, with new plates of lead, and finally, with a new bandage applied with the same care as the first.

The face, until now remaining free, was submitted to the same applications, but so arranged that it could be uncovered at any time, without disturbing the rest of the bandages.

The body was then covered with a cloth, surrounded with a mantel of satin, and deposited in a leaden coffin: it was left exposed to the air for *more than twenty-four hours, without exhaling any other odour than that of the aromatics employed.*

The operation which had commenced at ten o'clock in the morning, was not terminated until after two in the morning.

The operation was very painful on account of the gas, particularly the chlorine, which was freely exhaled towards the latter part of the process, fatiguing the assistants, who were all tormented with a very violent irritating cough.

Such are the details of this embalming, which had been announced as constituting the perfection

of the interesting necropsy described in one of the late numbers of the *Bulletin Clinique.*

A. LOREAU,
E. CHANUT.

What strange naiveté on the part of the embalmer! he had just stated that the operation was very painful on account of the gas, particularly of the chlorine, which was freely exhaled during the latter part of the process, very much fatiguing the assistants. Ought you not to have anticipated this, you who were charged with such preparations? Ought you not to have known even the inutility of such an incoherent mixture of substances?

It is not excusable, indeed, to be ignorant that the chloride of lime, (*chloride of the oxide of calcium,*) mixed with the deuto-chloride of mercury, produces, with the disengagement of chlorine, two new products, first, the chloride of calcium, (*muriate of lime,*) and the deutoxide of mercury, (*red precipitate,*) an insoluble substance, to which no one has ever attributed conservative properties. Upon what principle, further, upon what positive knowledge are we authorized to make so frequent use of the chloride of lime in embalming? No scientific data justifies this practice. Is it because it possesses disinfecting properties? But this is the very reason why it should be rejected, for in what manner does it act upon putrid miasmata? Is it not by decomposing them? No one doubts this, excepting always the embalmers; who are probably also ignorant that it possesses in the highest degree the property of decomposing animal and vegetable matter. I have

proved in the course of my researches, that *a fresh corpse, injected with one of the chlorides of the oxide of sodium, calcium, potassium, is in a complete state of dissolution, at the end of forty-eight hours.*

These researches, which I have pushed in various directions, have weighed hardest upon the substance which has been extolled as excellent, and as very superior to any thing used by the ancients in embalming: I applied myself to establish, as far as practicable, the precise degree of confidence that the deuto-chloride of mercury merited under these circumstances. It is very true that it preserves animal matter plunged into a solution of it; but to what degree, and under what rules? The following is a brief exposition:

1. Coarse anatomical pieces, (a preparation of the muscles of the arm, for example,) plunged into and maintained in a saturated solution of the deuto-chloride of mercury, and then dried, are protected from corruption, but they become brown, stiff, and so deformed as scarcely to be recognized.

2. The injection of this liquid is not sufficient to arrest the progress of decomposition—this salt not being sufficiently soluble.

3. The simple immersion of a corpse in it hardens the skin, but the muscles and all the viscera are decomposed.

4. The injection of it, followed by immersion, preserves the object well enough for the space of two or three months, but putrid decomposition attacks the thoracic and abdominal viscera, as well as the brain and thick muscles, at the end of this time.

5. A subject injected with alcoholic sublimate,

then opened, emptied, and macerated, afterwards exposed to the air, dries easily;[1] but it assumes a deep gray colour, and the tissues become hardened to such a degree, that it hardly preserves a human form. These are the rigorous results of experience. In the preservation by the aid of deuto-chloride, one portion of the subject is sacrificed to preserve a few remains; the most noble of all the organs, the brain, the throne of thought, cedes its importance to a few bones clothed with dried muscles, and a skin transformed, and not easily known again.

These are but feeble advantages, and paid for much too dearly; for the inconveniences and dangers of this mode of preparation, appears to us sufficient to cause them to be abandoned.

It is very expensive, dangerous for the operators; it alters the instruments, and the bodies which receive the influence of its emanations. Recently, during the embalming of some great personage, all the gildings of a vast saloon, where the operation was performed, were destroyed by the action of the deuto-chloride.

Nevertheless, the embalmings made with this substance, and of which the three first observations cited in this chapter are the most remarkable examples in our knowledge, afford the most decided expressions of the advanced state of the art.

What are the ameliorations resulting from our discoveries? They are as follows: 1. A substance easy

[1] The deuto-chloride of mercury, like the salts of copper, arsenic, iron, &c., are decomposed by gelatine, forming a new imputrescible compound. The preservation is much more sure if a large quantity of alcohol is used in drying the corpse.

to manage without danger to the operator, without any inconvenience to the instruments and other metals, is substituted for the sublimate; 2. The operation can be entirely finished in half an hour; 3. The numerous incisions, the mutilations, the subtraction of the viscera, &c., the prolonged maceration, are replaced by an injection through an opening of some lines in extent; 4. In place of a substance discoloured, leathery, and dried, reserving more or less the human form, my process preserves the subject, such as it is, at the moment of death, with the colour and suppleness proper to each tissue;* 5. Finally, the expense which, by the preceding method, amounts to from four hundred to two thousand dollars, need not now exceed sixty dollars. Thus a body may be indefinitely preserved for a sum less than the price of a leaden coffin furnished by the undertakers, *a coffin which accelerates the putrid decomposition, in place of preventing it.*

I confine myself here to the announcing of some results obtained by my predecessors; for previous to entering into details of the experiments which I have tried, it remains for me to trace the picture of the means employed down to our period for the preparation and preservation of pieces of normal anatomy, pathological anatomy and natural history. This will form the subject of chapter VII.

When I shall have made known the whole of the

* When we visited and gave an accurate examination of the numerous embalmed objects in M. Gannal's museum, we did not observe any specimens that had been finished long enough to dry, displaying such perfection as that here stated.—*Tr.*

resources of this other branch for the preservation of animal matters, each one can form an accurate opinion, after a complete knowledge of the facts, of the part which belongs to my labours, and of the place which they ought to occupy in the scale of natural sciences.

## CHAPTER VII.

### METHODS OF PREPARING AND PRESERVING SUBJECTS OF ANATOMY, PATHOLOGY, AND NATURAL HISTORY, PREVIOUS TO THE PROCESS OF GANNAL.

AMONG the investigations belonging to the domain of medicine, normal anatomy and pathological anatomy occupy the first rank; they constitute the necessary basis of exact study: all men of genuis have experienced this.

This conviction has been the source of the persevering efforts of numerous distinguished savans, who reasonably supposed that they would merit the esteem and gratitude of their species, if they could succeed in composing collections of engravings, or artificial models, representing the form, colour, &c., of each of the organs, or if they could discover methods of preparation capable of preserving the organs themselves with all the physical properties which they possessed at the moment of death.

It is not necsssary to enter into discussions upon the high importance of these different kinds of investigations; for every one comprehends it, and the gravest authorities have pronounced upon this matter. Who does not know the vast importance which our illustrious Cuvier attributed in the progress of the natural sciences, to him who first concieved the idea of preserving objects in alcohol? It is perceptible, indeed, at the first glance, that the most beauti-

ful and valuable of libraries for the physician and naturalist would be a collection of artificial subjects; or still better, of all the organs of the bodies of animals, and of man, skilfully prepared and preserved, without any alteration of the properties which it is important to know.

It must be admitted that a collection in which all the organs would be disposed in series, where they would be seen passing by their successive degrees of increment and decrement, offering their differences, individual and sexual, their points of contact and separation in the various classes of the animal kingdom, their anomalies, their pathological affections, their intimate structure, &c., it must be admitted I say, that such a collection would be an inexhaustible source of knowledge; it would acquire additional value by the addition of a series of pieces representing the detailed anatomy of each of the parts involved in surgical operations.

But this library, so eloquent and instructive, does it exist at the present time? Do we possess the means of forming such? The examination of the various processes, ought to furnish us with an answer to this question; it will besides enable our readers to estimate for themselves the part that our method may enjoy in the accomplishment of this object.

And first, in admitting the utility of *engravings* of *models in wax*, and in *artificial carton*,* in *white wood*, or in other compositions kept secret by their authors, we feel that whatever may be the accuracy

* A composition of papier maché, with which Dr. Azoux has so beautifully represented anatomical subjects.—*Tr.*

of these different representations, they never can afford but an incomplete idea of the thing represented. 1st. *Plates and engravings*, so advantageous for reference, to recal the study made upon the corpse, have lost their importance in proportion as the means of obtaining dead bodies have become more easy: they are calculated to render great service and contribute to the progress of science in the fine anatomical works of Meckel, Lauth, Haller, Zinn, Hunter, Cruikshank, Cowper, Vic–d, Azyr, and of numerous other learned authors; at the present day, even, they are justly esteemed in the great works of MM. Cloquet, Bourgerie, &c. (The plates of the work of M. Bourgerie, are executed with remarkable care, and will form an epoch in the history of anatomical works.) But they occupy a secondary place, only to aid the memory; for of whatever good they may be, they must always have many inconveniences: 1. They fatigue attention, because it is necessary so often to multiply the figures, when it is requisite to examine an object under all its aspects where it is of importance to perceive it; 2. The organs are rarely seen of their natural dimensions; 3. Whatever may be the exactitude of the drawing, it is difficult to form a just idea of the relief and dimension of the organs; 4. The relations which they indicate are always incomplete; it is impossible thus to represent all the organs in their position, and in their natural relations.

2d. *Models in wax*, nearer to nature than plates, reproduces objects with admirable truth for the eye, but for the eye only. They were recently estimated of such importance, that courses on modelling

were introduced into the schools in many cities of France; nevertheless, it cannot be concealed that pieces thus prepared leave much to be desired: 1. The relations of the organs which they indicate are very limited: 2. It is necessary then to multiply them to infinity, if it be desirable to represent under various points of view, the different points of the human body, which is indispensable, in order to comprehend their relations and connections: 3. And still the mind comprehends with difficulty the totality of objects viewed in a great number of pieces: 4. They cannot be handled and displaced as is requisite for study, without injury to them.

3d. *Artificial pieces*, which possess many of the inconveniences of wax models, are more proper to give a knowledge of the parts, which enter into the structure of man; nevertheless, if they be white wood, like the subjects of Fontana, or in Carton, like those of Ameline, or of M. Azoux,[1] they leave much to be learned of the properties which are requisite to an accurate and complete knowledge of the parts. Finally, these three means of communicating knowledge possess their degree of utility, but they can never support a comparison with the proper matter of the organs; they may serve to complete a museum, but never to form one; so we content ourselves to mention them here, in order to assign them a rank. Anatomical pieces which place before the eyes the organs, themselves, are then the

[1]The subjects prepared by M. Azoux, are however, more proper to facilitate and extend the study of anatomy; they are far superior to dried objects. It is desirable that every amphitheatre should possess one of these subjects.

elements, "par excellence," for the formation of collections, which are to serve as studies of normal anatomy, of pathological anatomy, and of natural history, but, the preparation and preservation of these pieces is a new science; we ought not to be astonished at it, notwithstanding the advanced state of our anatomical knowledge, if we reflect on the difficulties of all kinds, which prejudice excited in our predecessors. It is stated, it is true, that Ruysch, had discovered the means of preserving the dead body, with *all the appearance of life, without drying, with florid complexion, and supple limbs.* But, is this really the fact? and have we not good reasons to doubt such assertions, since no collection of anatomical pieces, prepared by this process, has decended to us, and no explanation has confirmed our knowledge of them?

We may then conclude, that the means of preparing and preserving, does not date much earlier than the commencement of the present century. None of them, however, has had for object the preservation of the entire subject: that which offers us the most numerous parts united in the same preparation has only a reference to anatomy, properly so called; it is the process of M. Swan, of England, given by him as a new method of making dried anatomical preparations, preserving to them the appearance and the advantages of fresh preparations, without possessing the inconveniences of them; this process is, as we shall see, only an application of the discovery of Chaussier, on the preservative properties of the deuto-chloride of mercury. We give it

here, before passing in review the methods of preparation practised for each organ or each tissue.

"In order to describe the manner of making these preparations, I shall only take the arm by way of example.

"The member should be selected as clear form fat as possible. A solution of two ounces of oxymuriate of mercury, in half a pint of rectified spirits of wine, must be injected into the arteries, and the day after make another injection with the same quantity of white spirit varnish, to which must be added one-fifth part of turpentine varnish, and a small quantity of vermillion. The limb should next be placed in hot water, and remain there until it is sufficiently heated for a coarse injection into the arteries, and even the veins if necessary. If the veins are to be injected they had better be emptied of blood, with water, before forcing into the arteries the solution of oxymuriate of mercury, because there returns always by the veins some portion of this injection which coagulate the contained blood, and hinders the coarse injection from passing into the smaller branches.

"After the limb has been injected it may be dissected. Every time the work is left, it is better that the parts uncovered, should be enveloped in a linen cloth wet with water; and when the dissection is recommenced a great advantage will be remarked, which is that the parts injected with the solution of the sublimate will suffer very little alteration in several days, and are found in the same state in which they were left, whilst, by the common method, in one or two days, all is so changed that

there is little profit in seeing what has been done, and if the dissection is long, they will scarcely be recognised when finished.

"Another advantage is that it may be dissected any where, since the preparation is without odour.

"When all the parts are uncovered, and all the fat and cellular tissue has been removed, the member thus prepared must be put into a solution of two ounces of oxymuriate of mercury, to one pint of rectified spirits of wine, and let remain entirely covered with this for at least fifteen days, for it cannot remain too long. A box of oak, painted white and varnished is the best recipient for the limb, whilst in solution; the cover must fit closely, in order to prevent the evaporation of the spirits of wine.

The member must be withdrawn every two or three days, and any remaining cellular tissue is to be removed, and when retured to the tub the part which previously touched the bottom must be placed uppermost. The best thing upon which to place the preparation, when withdrawn from the solution, is a butcher's tray, after having been well oiled; without this precaution the tray imbibes moisture, from which results a great loss of the solution. When the limb has remained long enough in the solution, it is to be taken out, to be painted and varnished.

"Before proceeding to these operations, the member kept in a state of extension, is suspended and dried, then endued with white varnish. On the same day the nerves, the tendons, and tendinous expansions, ought also to be varnished; which must be repeated once a day, for three consecutive days. The fifth day, the tendons, ought to be covered with a layer of

yellow varnish, and white paint mixed in equal parts; this operation is to be repeated the seventh, eight, and ninth day. The nerves, must also be endued, as often as necessary, with a mixture of equal parts of white paint, and white varnish.

"As soon as the muscles have become stiff, they may be painted, taking care that the nerves and tendons, are not touched by the paint. Nearly a month after the limb has been withdrawn from the solution, those of the nerves and tendons that are not sufficiently coloured should be repainted and varnished, as often as may be judged necessary. But always allowing a day's interval between each application of paint and varnish.

"These operations being finished, wash lightly the tendons and nerves with boiled flax seed oil; this layer being dry, give a second over the whole limb; finally, several layers of copal varnish will terminate the operation. The first layer of copal varnish to be applied to the arteries with a slight addition of vermillion, and of Prussian blue, for the veins.

"In order to preserve the liver, it is necessary first to inject the vena porta and excretory ducts with white varnish, to which has been joined one-fifth of turpentine varnish, and some coloring matter, such as red lead. Then make the coarse injection, after which the liver is to be put into the solution for a least fifteen days; it is not necessary to heat it before injecting. The ligaments are to be prepared in the same manner as the tendons.

We give below the paints, and varnishes, employed in the preceding preparations:

### 1.—*White Varnish.*

℞ Canada balsam, spirits of turpentine, *a.a.* 3 ʒ.
Mastic Varnish. 2 ʒ.

Put the whole in a bottle, and agitate until it is perfectly mixed.

### 2.—*Mastic Varnish.*

℞ Powdered mastic. 4 ʒ.

Dissolve in a pint of spirits of turpentine.

Agitate daily, until the mastic is dissolved.

### 3.—*Yellow Varnish.*

Infuse one ounce of gum-gutta in powder in eight ounces of spirits of trupentine for fifteen days; then, with equal parts of this clear drawn liquor, Canada balsam, and mastic varnish, form the yellow varnish.

### 4.—*White Paint.*

Three ounces of white lead, and an ounce of spirits of turpentine serves to form it.

### 5.—*Paint for the muscles.*

It is made of Lac, Prussian blue, and white varnish, to which is added one quart of turpentine varnish.

### 6.—*Red Injection.*

℞. Wax, 4 ʒ.
Copal varnish, ½ ʒ.
Red lead, ½ ʒ.
Vermillion, 1 ʒ.

Melt together.

7.—*Green injection.*

| | | |
|---|---|---|
| ℞. | Wax, | 4 ʒ. |
| | Blue dross, | ½ ʒ. |
| | Copal varnish, | ½ ʒ. |

8.—*Blue injection.*

To form this it is only necessary to add to the green injection, half a drachm of powdered Prussian blue. The advantages of such preparations do not answer, in any degree, to the promises of the title; the artificial preparations of M. Azoux are much more preferable, since his cartons represent the form which the anatomical pieces of Swan have lost by desiccation.

SECTION 1.—*Generalities of the operations which precede preservation.*

Desiccation and immersion in liquids are the only means of preservation.

The choice of subjects which are to serve for these preparations, says M. le Docteur Patissier, is not a matter of indifference. Young subjects, and lean women, are preferable for the nerves and bloodvessels; adults, and thin and dry old men, for the preparation of bones which it is intended to articulate, and which it is desirable to obtain in their greatest degree of development; individuals of an athletic constitution for muscular preparations.

The most favourable time for the preparation and preservation of anatomical subjects, is generally during a cold and dry winter, or the ardent heat of summer; the more rapid is the evaporation of the

humidity of animal matters, the more sure is their preservation.

The method of preservation ought to be preceded by some other operations, such as *dissection, maceration, injection, ablution, corrosions, ligature of vessels, separation and distention of parts.*

*a. Dissection.*—It consists in stripping the part which it is intended to preserve, of the tissues and organs which are foreign to it: if the object be the preparation of muscles, for example, these organs are left alone with their insertions in the bones, or rather, the vessels, previously injected, preserve their relations with the muscles and the bones. Nevertheless, in the dissection of the hard parts, whether it is proposed to follow the branches of the vessels and nerves which penetrate, or are distributed in their substance, or whether it is desired to develope and render their organization more apparent; it is less convenient to have recourse to instruments than to chemical re-agents, which bring into view the parts which it is desirable to study. When the object is the preparation of a bone only, the operation consists of two parts, *excarnation*, and *etiolation*, the details of which will be presented in the article upon bony tissues.

*b. Macerations and corrosions.*—These operations are frequently brought into use by the naturalist: water, acids, alkalies, volatile oils, &c., serve to produce varied effects in the preparation of the different tissues. The maceration of different portions of the skeleton is produced by water. The employment of other liquids has for object, in attacking several

parts which they dissolve, to expose others which it is desirable should be left bare.

Thus, in order to absorb the grease which exudes from the skeletons of certain fish, or of bones, the maceration of which has not been perfected, it is useful to steep the piece in a marly alluminous paste, which must be alternatively put to dry and soften in the sun, in order that the clay may absorb the fetid oils with which the bones are impregnated.

In order to dissolve the grease with which certain parts are covered some time after their preparation, as happens to some natural skeletons, it is often necessary to steep the piece in an alkaline liquor, or rather, to allow it to macerate for some weeks in a very penetrating volatile oil. It is only by the aid of such processes that we are able to follow encephalic nerves in many of the cetacea, although these parts present in these animals extremely singular dispositions.

It is with the same view that should be macerated either in water elevated to a certain degree of temperature, or in acid liquors, the hard tissues, in the interior of which it is proposed to denude certain parts. Thus the nerves and vessels of the roots of the nails, the horns, the skin, cannot be well exposed but by this process. The canals, which traverse certain bones, cannot, as we have already shown, be easily followed, unless the peice has remained for a longer or shorter time in an acid liquor.

Macerations in alkaline and etherial liquors are

still of great assistance, as the researches so happily conceived and executed by Bichat have proved.

Finally, corrosions are indispensable to the removal of the parenchyma from injected preparations, when it is intended only to preserve the interior network of vessels.

The following are the attentions which this operation exacts: The injected part is consigned to a vessel of pure water for two or three days, which is occasionally to be renewed, in order the better to disgorge the vessels of any blood they may contain. It is afterwards to be solidly fixed on a piece of wax at the bottom of a porcelain vase, pierced with holes near the base, through which the liquor used to wash them may flow off without deranging the vessels. This corrosive liquor is the muriatic acid, or spirit of salt; the aquafortis of engravers, or nitric acid, may be used for the same purpose.

The first time, the preparation is to remain two or three hours in this acid, which is then drawn off and replaced by the same quantity of water, which is allowed to flow on it in small streams. This water is left for four or five days, according to the season, until the water begins to be covered with a scum, and the preparation begins to be cottony at its surface; the liquor is poured off a second time, and the pot or vase is placed beneath the cock of a fountain, from which escapes a delicate stream of water, which will carry off slowly and without shocks, any detached parts; when it is perceived that the washing carries off no more animal matter, the acid is poured into the pot, of which the opening is to be reclosed with a stopper of glass or por-

celain, warmed and endued with wax. This operation is to be repeated every four or eight days, until the tunics of the vessels are altogether denuded, and the injected matter is seen throughout.[1]

*c. Injections.*—These are *evacuative, repletive, antiseptic,* or *preservative.* The first have for object, as their name indicates, to disembarrass the vessels or hollow organs, of the matters and fluids which they contain; they consist of water, of acids very much reduced, of diluted alcohol, &c. Thus it is serviceable to inject water or alcohol into the bloodvessels to prepare them for the reception of the repletive and preserving injections. The second are either definite or temporary.

The substances employed in these injections are vehicles for colouring matter. The nature of the vehicles determines that of the colours, which ought to be as far as possible, analogous to those of the humors, which the vessels contained during life.

As vehicles, those fluids which always retain their fluidity are rarely employed, for parts thus injected cannot be dissected, and they are, besides, apt to allow the colouring matters which they contain in suspension, to be deposited.

Liquids saturated with glue or gelatine, made use of in ordinary injections, have the inconvenience of not being equally solidifiable at different degrees of temperature, or harden too rapidly by cooling; they are made with the glue of commerce, either simple, or mixed with gummy or saccharine matter; that

[1] These details on maceration and corrosion, are extracted from a work full of interest of Professor Dumèril: Essay on the means of perfecting and extending the anatomical art.—(*Paris*, 1803.)

commonly used, is called Flanders glue, although it is manufactured in Paris, and that called mouth glue, which only differs from the other in containing a little gum or sugar. That which succeeds best, because it melts with the heat of the hand, and which nevertheless coagulates at a temperature of twenty-five or twenty-six degrees of Reaumer's themometer, which is one of the highest points to which our atmosphere attains, is made of the membranes of fishes, or icthyocolla. An ounce is to be melted in a sand-bath, in double its weight of water, and mixed afterwards with two ounces of alcohol, previously warmed. In these sorts of gelatinous injections, there is much choice in the colouring matters. All those that are ground like gum, and which are used in miniature painting, and in painting "a la gouache,"* may be employed; they remain very well suspended.

The sticks of carmine of Delafosse, and the carmine lacks of Hubert, may then be used with advantage for the arteries; for the veins, Prussian blue, ground in vinegar, and the white of zinc of Antheaume, or that of oyster shells well porphyrized, for the colour of metallic oxide is subject to change in animal matter; they are also subject to the inconvenience of becoming precipitated by repose before the vehicle cools, and thus obstruct the smaller vessels.

Liquors which can be made solid by the effect of certain re-actives, offer, on this account, some advantage. It is thus, that it is serviceable to soak for a

*Paintings where colours are employed diluted with water or gum.—*Tr.*

day or two in a solution of nut-galls or of tannin, those parts injected with gelatine, when it is intended to preserve them dry. In partial injections of lymphatic vessels, and particularly of the chyliferous, cow's or goat's milk, may be made use of. When, after having tied the thoracic duct, injections of milk have been made into all the vessels in which can be introduced the beak of a glass syringe, or of the syringe used for injecting the lacrymal ducts, pour on the surface of the injected parts strong vinegar, or a diluted acid, which will coagulate the milk, so that the chyliferous vessels will be found filled with a solid, white, and flexible.[1]

The most common, the most solid, and the most convenient injections, are made of fatty and resinous matter. Volatile oils, balsams, resins dissolved in alcohol, fats, wax, and the most ordinary fixed oils, are principally used. These different substances are combined, and the compositions of them are varied according to the nature of the injections, which it is desirable to prepare, and above all, according to the manner which it is proposed to preserve them.

The nature and the preparation of the colouring matters, ought also to vary according to the kind of fatty medium which is used.

The volatile oils being nearly equally penetrating, turpentine is generally chosen, because it is cheaper. Nevertheless, for small objects, the citron, or that of a species of lavender (aspie of the shops) is pre-

[1] There are some specimens in the museum of Natural History prepared by this process.

ferred, on account of their odour, which are besides not very expensive. When it is intended to inject only with one of these oils, which makes a liquid matter extremely penetrating, after having dissolved a colouring matter previously ground in a fixed oil, the mixture is slightly heated. This liquor is generally employed to render perceptible the small vessels of membranes, which are not to be dissected, but well preserved in their integrity. If it is intended to inject the large trunk which supplies these membranes towards the end of the operation, it is necessary to inject a little essence of varnish, charged with much resin, and before drying the piece, let it soak a day or two in an aqueous solution of the deuto-chloride of mercury, according to the process of Chaussier.

The matters with which the volatile oils are to be coloured, should be previously ground with the greatest care. It is easy to procure those which are prepared with nut oil, and which are sold in little bladders to be employed upon palettes.

Colours, thus prepared and intimately amalgamated with fixed oils, remain much better suspended; the heaviest oxides, even those of lead and mercury, are not then subject to become deposited.

Resins, dissolved in spirits of wine, are also sold by the pint, all prepared, under the name of varnish, and in general are not costly. Those which the anatomist can turn from the ordinary arts to his own profits, are employed principally in pieces which it is intended to preserve dry. Perfect success attends the varnish, named in the shops *fat*,

*wood-red, à la copale,* and with some others which remain a long time flexible.

These fluids are difficult to colour ; it is necessary, for the first, to grind the colouring matter with essence, and for the others with alcohol; and to incorporate them afterwards with varnish after having slightly heated them. The carmined lakes, thus suspended in fat varnish, produce absolutely the effect of arterial blood; this colour preserves very well, and with such like injections it is unnecessary to colour the surface of the arteries.

The mixture of mutton fat or of suet, of white or yellow wax, of the fixed oils of olives, nuts, or flax seed, are the ordinary matters of injections, even for those destined for corrosions. The different degrees of solidity or softness are determined by the calculated proportions of wax and oil, and by the amalgam of resinous and colouring matters.

In general, in this sort of injections it is advantageous to introduce beforehand, a small quantity of volatile oil mixed with the fatty matter which is to serve for filling the vessels; by this preliminary process a liquid more fluid, more penetrating, higher coloured, and susceptible of cooling more slowly, is driven before into the smaller ramifications.

I could here transcribe several receipts proper to indicate the proportion of fatty matters among themselves; but the season during which the pieces are made, the nature of the ingredients employed on them, will occasion the proportional quantities to vary, so that a sketch only can be given for obtaining a matter which may be made more solid or more fluid after having tried it by cooling some

drops separately. Nevertheless, here is one of those receipts:

| | | |
|---|---|---|
| ℞. | Of suet, | 5 parts. |
| | Burgundy pitch, | 2 " |
| | Oil of olives, or of nuts, | 2 " |
| | Of fluid turpentine and colouring matter, dissolved in volatile oil, | 1 " |

This latter part should not be mixed until the liquor is well melted and ready to be put into the syringe, as the heat will volatilize the volatile oils, which will become disengaged in the form of gas, and cause the mass to occupy a very great volume.

As a matter of injection, the dissolved gum elastic or caoutchouc may be employed; it becomes gelatinized in losing a portion of its menstruum by desiccation. After leaving this matter in a moist place, and having well washed it, in order to clean it of the clayey matter which generally impregnates it, it may be dissolved in volatile oils by heating it in a sand bath, with a moderate fire in a matrass with a long neck; adding by degrees, a sufficient quantity of oil to render the mass very fluid, incorporating with it the colouring matters which have been previously ground in an essential oil. The gum elastic may also be dissolved in ether, but this process is too expensive; and as a matter for injecting this liquor is not preferable to the other. The elastic injections are only advantageous in the preparation of parts which are not to be exposed to cutting instruments, and to which it is desirable to preserve a certain degree of suppleness, as in the injection of the cotyledons, or the placenta of women. This li-

quor, it must be confessed, has the great inconvenience of retaining its odour a long time, assuming its solid form with difficulty, and of rendering the preparations pitchy, and rebellious to varnish, and becoming loaded with dust.

There are certain organs which may be injected with solid matters, in order to obtain, in relief, resisting, but coarse, the forms of interior cavities. Such is the injection with the matter which forms the stucco paste, or of fine plaster diluted with gelatinous water, which gives to this salt a greater solidity when it takes its consistency. This gross matter is employed with advantage to render more solid the membranes of certain cavities, in the thickness of which it is desired to search for the nerves. Pure wax does not present the same advantage, because it exacts more heat, and contracts more by cooling, although it is more applicable in case it is proposed to corrode with acids all the fleshy or osseous parts, in order to become acquainted with the real form of their interior capacity: in fine, the fusible metallic mixture of Darcet is employed under different circumstances, but it is not more useful.[1]

Preservative injections, which may also be applied to vessels and to hollow organs, are composed of materials to which have been attributed preservative properties to the tissues: such are the solutions of mercurial salts, arsenical, ferruginous, &c., and different aromatic and spirituous liquors.

*d. Ablutions*—These vary according to the end roposed: acids; these serve to give whiteness to

[1] M. Dumèril, work cited.

some tissues and resistance to others: alkaline; these clean the preparations, divesting them of the mucilage and grease which they contain. In one word, the action of aqueous liquids, of oily, alkaline, saline, acid, alcoholic, is necessary before, as well as after dissection to preserve the preparations.

When these preparations are left a longer or shorter time in water, they are subjected to what is called a *degorgement;* the bath ought to be renewed until it will no longer receive any colouring matter.

The removal of *grease* is included under dissection, maceration, and ablution.

*e. Ligature of the vessels.*—This is made with a flat silk, or silk very slightly twisted, during the dissection, or immediately after, on the extremity of the vessel which contains the injection; it is necessary in order to prevent the escape of the injected matter.

*f. Separation and distention of parts.*—These offer the whole surface of the prepared pieces to those agents of preservation which ought to be applied to them; they sustain them, and preserve them from being deformed. Besides, it is well known, that the means of separation and distension ought to vary according to the form of the organs; atmospheric air suffices for hollow and thin organs, the stomach, the intestines, the bladder, &c. Under other circumstances, wool, hair cotton, plaster, &c., serve better.

## SECT. 2.—*Means of Preservation.*

The means of preservation may be arranged under two principal heads, as we have said, according as the anatomist intends to expose his preparations to the open air, or to preserve them from insects and render them more transparent by the aid of certain liquors, in which it is intended to keep them continually.

*Preservation by desiccation.*—When applied to soft parts is only applicable to anatomy, properly so called, and to natural history; it cannot be employed for specimens of pathological anatomy.

Desiccation is preceded by a more or less prolonged immersion, according to the thickness of the organs in acid or saline solutions, &c.; that which presents the greatest advantage for the nerves, according to Dumèril, is diluted nitric acid. The salts commonly employed present some inconveniences. Corrosive sublimate hardens too much, and causes the parts to contract on each other; the triple sulphate of alumine, (alum,) often chrystalizes in drying, which produces in the interior of the piece, which ought to be pellucid, saline vegetations, which not only elevate the organic lamina, often rendering the surface tuberculous, but further deprive the part of the transparency necessary to see the texture of it; the muriate of soda, (white kitchen salt,) attracts the humidity of the air, and causes the varnish to scale off, which can have no hold upon the preparation. Diluted nitric acid, with which the parts are washed, does not expose them to these inconveniences: the preparation preserves, it is true,

a certain degree of suppleness; it tarnishes a little, but is never humid.

The numerous means used for disposing the preparations to desiccation, may be reported under four series:

Alcohol, where expense is no object, is preferable to all the others; its affinity for water gives it the property of absorbing humidity from anatomical pieces.

The deuto-chloride of mercury, the proto-nitrate of the same base, the solutions of acetate of lead, and of the proto-nitrate, merit the preference among metalic substances.

Marine salt and alum are nearly those alone among the earthy salts which have been employed for this object. M. Breschet advises that, according to the method followed by the tanners, the piece be permitted to remain for several days in powdered sea salt, and to immerge it afterwards in a strong solution of alum for fifteen days, when it is to be withdrawn and dried.

In fine, tanning is still a preparatory method for desiccation.

*Desiccation.*—Anatomical pieces may, says M. Doct. Patissier, be dried in the open air, in a stove, in a vacuum, and by employing substances very avaricious of water, and in a bath of sand, or of absorbing powders; but desiccation by means of an oven is the best process: the heat of the oven must be neither too weak nor too strong; the most convenient temperature is that of 45° to 55° of centigrade.

When the parts have been dried by one of the processess just mentioned, if they be abandoned to

themselves, they would become injured in a little time by humidity and insects. There remains, then, some care to be taken before depositing them in a cabinet; they should be washed in a liquid containing a preparation of arsenic, or of sublimate, or rather by applying to them a varnish containing one or both of these substances. We shall not reconsider here the compositions of varnishes, having already given several formulæ for them when speaking of Swan's method, and we shall have occasion to refer to them again when passing in review the different methods of preparing objects of natural history.

*Preservation in liquids.*—Anatomical parts are also preserved, and more advantageously, in liquids. We shall now consider the acids, or acidulated waters, alkalies, salts, oils, spirituous or alcoholic liquors; expose their advantages under certain circumstances, their inconveniences under others.

When acids are employed for preserving anatomical parts in their natural state of suppleness, caution must be used to dilute them, with a sufficient quantity of water, so that they may not corrode or harden the parts. In general, it is advantageous to allow them to remain for the first few days, in a very weak acid, and not place them in the prepared liquor, until they have ceased to make any deposit. The objections against muriatic acid are, that it renders the surface of the parts gelatinous, gluey, and transparent; of nitric acid, to tarnish and contract them; of sulphuric acid, to bleach them. All these acids decompose the parts when they are not sufficiently diluted with water; they allow the

liquor to putrefy or to freeze, and break the vessel when they are too weak. The proportions are indicated by experience, and depend upon the nature of the part which it is intended to preserve. It is those parts in particular which are loaded with fat, that are best preserved in acid liquors.

In general, little use is made of liquors which hold alkalies in solution: the carbonates of commerce are preferable; and these are used with advantage, when it is necessary to keep for several days, before dissection, animal parts in which corruption has already commenced.

Those salts derived from the combination of acids and earths, the alkalies or metals, may be employed like the acids diluted with water. They are not subject to the same objections. The nitrate of potash, the muriate of ammonia, those of lime, or of soda, are very proper for preserving pieces of myology; they appear even to reclaim the red colour of the muscles, when these solutions are strongly saturated; but, then, they are liable, some of them, to liquify, others, to effervesce or to chrystalize upon the sides of the jars, and even on the surface of the parts themselves, which is a very great inconvenience when it is wished to expose the parts to view.

The solution of the triple sulphate of alumine, (alum of commerce) is employed with the same advantages; it must be confessed, however, that they are more proper to preserve membranous parts which have been previously allowed to macerate a long time. In general, this liquor discolours the parts, and deposits at length on the sides of the jar and the surface of the piece which it bleaches, the

white earthy matter with which it is charged; this is a great objection, and exacts great care when the atmosphere freezes suddenly.

Chaussier has latterly proposed the solution of the deuto-chloride of mercury, in distilled water. This liquor is very useful, but it bleaches the surface of the parts, particularly the muscles; it hardens, and attacks the instruments when new researches are attempted, upon parts already prepared. This discovery, however, is very valuable to obtain the mummification of certain parts, which it is intended to preserve in the open air. In order to obtain a solution always equally saturated, Chaussier,[1] has proposed to keep at the bottom of the liquor two or three knots of fine linen enclosing a certain quantity of this metalic salt, in order that the saturation may always be complete.

In general, we repeat, these preservative liquors are attended with the great inconvenience of leaving suspended, after frosts, the albuminous matters which the cooling has caused to precipitate; so that the fluid of the vessel which contains the preparation becomes clouded, and no longer permits the object so be clearly seen. Besides, the liquor freezes, and breaks the jar, when the temperature is very low.

The volatile oils, from whatever vegetable they may have been extracted, are very proper for the preservation of anatomical objects; they lose at length, it is true, their transparency; they thicken, precipitate to the bottom of the vessel, the animal

[1] See Bulletin des Sciences, by the Philomatic Society, Vol. 3, 6th year, No. 3.

fluids which exude from the object, which exposes them to corruption. But all these changes are sensible to the eye, and the fault is easily repaired when perceived in time to renew the liquor, which may be afterwards re-distilled.

It is never useful to employ these liquids for the preservaiion of objects loaded with fat, for they dissolve these at length and penetrate them entirely, changing their form and colour.

Volatile oils, and particularly turpentine, which is the best, are employed to preserve with the greatest success certain injections, the vehicles of which would be dissolved in alcohol, and all the parts whose vessels have been injected with coloured gelatine; finally, these oils are used in all cases where it is desirable to perserve the transparency of certain membranes, which have been previously dried.

Alcoholic liquors are most generally used for the preservation of animal substances, if they are more costly, they are liable to fewer objections. Brandy, rum, tafea, are coloured by a resinous substance, which clouds their transparency, and which is liable to be deposited. The alcohol of cherries, of grain, of cider, or of wine, is preferred at present, which can be procured well rectified and transparent, and which may be afterwards weakened with distilled water, so as to obtain alcohol very limpid, marking from 22° to 30° of Baumè's areometre.

Some years since, alcohol was still employed, in which was dissolved certain transparent resins; such as camphor, but it has since been ascertained, that animal substances which have remained in this

liquor, contract such a disagreeable and nauseous odour, that it becomes very painful to keep them long uncovered for examination, consequently, pure alcohol is preferred.

Nevertheless, when it is desirable to preserve the preparations of the nerves, it is better to put a few drops of muriatic acid into the jar along with the spirits of wine: this mixture bleaches and renders more visible the nervous fibres, on which the acid appears to act more specially. The yellow tinge, which the parts sometimes assume in the end, may sometimes be removed by pouring a small quantity of muriatic acid into the jar which contains them: this precaution occasionally gives a new aspect to the parts.

We have chosen this passage of M. Dumèril's pamphlet, because it gives with sufficient accuracy all the liquids employed by preparors, and because it indicates a part of the inconveniences which we have experienced from them.

We shall see to what extent the more recent additions made to sublimated alcohol, of hydrochlorate of soda, (chloride of sodium,) of the hydrochlorate of ammonia, of the muriate and nitrate of alumine, can contribute to the wants of the collector of pathological anatomy.

Before entering into this critical examination, it remains for us to describe the processes employed by naturalists for preserving the different species of animals. The excellent manual of M. Boitard, so useful to preparors, will furnish us with this information.

*Means of preparing and preserving practised by*

*naturalists.*—The soap of Bècoeur enjoys with naturalists a great reputation as a preservative. It is this preservative, then, that we should recommend as the most approved by experience: the following is the receipt:

| | |
|---|---|
| ℞. Arsenic puberized, | 2 ℔. |
| Salt of tartar, | 12 ʒ. |
| Camphor, | 5 ʒ. |
| White soap, | 2 ℔. |
| Powdered lime, | 8 ʒ. |

In the original, four ounces of lime is recommended, and we have given this dose in our first edition; but it has since been found by doubling it, the preservative is less pasty, and less difficult to use, more abundant and equally good.

M. Simon thus composes the preservative, but he adds to it a certain quantity of corrosive sublimate, and of camphor dissolved in spirits of wine. The camphor, thus incorporated with the preservative, does not volatilize so easily as when used in powder.

When used, a sufficient quantity is placed in a small vessel, and, with the aid of a hair pencil, it is moistened with water and spread upon the piece to be preserved.

Some naturalists, fearful of the danger of the daily use of arsenic, have endeavoured to replace this preservative by another composition, but have never succeeded in obtaining results equally advantagous; but, nevertheless, in order to render this work as complete as possible, and to facilitate new researches, we thought that we should at least, in-

dicate here, the different processes which have by turns been imagined.

In my cabinet of natural history, I have indicated, under the name of *soapy pomatum*, the following composition:

| | |
|---|---|
| ℞. White soap, | 1 ℔. |
| Potash, | ½ ℔. |
| Powdered alum, | 4 ʒ. |
| Common water, | 2 ℔. |
| Oil of petroleum, | 4 ʒ. |
| Camphor, | 4 ʒ. |

M. Mouton de Fontenille proposes a tanning liquor thus composed:

| | |
|---|---|
| ℞. Quinquina, | 1 ʒ. |
| Grenada bark, | 1 ʒ. |
| Oak bark, | 1 ʒ. |
| Gentian root, | 1 ʒ. |
| Absynthium, | 1 ʒ. |
| Tobacco, | 1 ʒ. |
| Powdered alum, | 1 ʒ. |
| Common water, | 2 ℔. |

Boil the whole, except the alum, which is not to be added to the liquor until withdrawn from the fire; it is to be put into a well corked vial for use.

M. Mouton thus uses his liquor: when an animal is skinned, and the skin divested of grease as well as possible, the internal surface is to be moistened with the tanning liquor until it is perfectly impregnated; if it be a dry skin, it is to be moistened in the same manner until it is softened.

An author has recommended, under the name of *antiseptic powder*, the following composition:

| ℞. | | |
|---|---|---|
| | Arsenic, | 1 lb. |
| | Calcined alum, | 1½ lb. |
| | Purified sea salt, | ½ lb. |

The whole to be reduced to a fine powder and well mixed.

We advise that powdered arsenic never be used, because, by volatilizing, it might penetrate the lungs and cause mortal ravages.*

The preparor Nicholas recommends, in certain cases, a composition which ought to be here mentioned, not to advise the use of it, on the contrary, to advise the rejection of it; for far from driving off the insects, it attracts them; he calls it *gummy paste.*

| ℞. | | |
|---|---|---|
| | Colocynth, | 2 ʒ. |
| | Gum Arabic, | 4 ʒ. |
| | Amidon, | 6 ʒ. |
| | Cotton, hashed fine, | 1 ʒ. |

Other preparors, without passing any thing over the skin, confine themselves to the use of the following powder:

| ℞. | | |
|---|---|---|
| | Calcined alum, | 3 ʒ. |
| | Flour of sulphur, | 1 ʒ. |
| | Black pepper, | ½ ʒ. |
| | Powdered tobacco, | ½ ʒ. |
| | Powdered sabine, | ½ ʒ. |
| | Powdered camphor, | 3 ʒ. |

The whole to be finely powdered and well mixed.

* In this country, powdered arsenic is almost exclusively used by preparors—and is alone sufficient for this purpose—the arsenical soap is not sufficiently strong; no fatal effects have been known to follow its use; care should be taken to wash frequently.—*Tr.*

Some amateurs content themselves in passing over the internal surface of the skin they wish to preserve, a good layer of melted suet mixed with a small quantity of corrosive sublimate; it appears that they have obtained some advantageous results, which authorises further experiments; it has been remarked, that suet is never attacked by insects; perhaps, if it were combined with some mineral matter less dangerous than the sublimate, results as satisfactory as those from the arsenical soap of Bècoeur might be obtained.

Such are the preservatives which have been employed in France, but which do not possess, to any extent, the efficacy of the arsenical soap of Bècoeur. It appears that the Germans employ others to which they attribute the same qualities, which appears to us very doubtful in all cases: they may be mentioned here.

Naumann, in the first place, gives a method which appears to us vicious, although he invokes in its favour his own experience. After having said that the best method of preserving is to close hermetically, stuffed animals in boxes, he adds: "I do no more for skins which are to travel in boxes, than powder them with the following composition:

"Of lime decomposed in the air, and finely sifted, two parts; of saxony tobacco, also sifted, one part.

"Hoffman approves of, and recommends the following powder:

| | |
|---|---|
| ℞ Sal ammmoniac, | 1 ʒ. |
| Calcined alum, | ½ ʒ. |
| Saxony tobacco, | 3 ʒ. |
| Aloes, | 1 ʒ. |

"The librarian of Jena, M. Theodore Thon, proposes the following powder, as better for preserving animals in the open air.

| | |
|---|---|
| Cobalt, | 1 ʒ. |
| Alum, | 2 ʒ. |

"To be powdered and mixed. Before employing this powder, give a layer of essence of pine, (turpentine,) in order that it may adhere better to the interior of the skin. If the latter be very greasy, add an ounce and a half of lime decomposed in the air and sifted.

"Among the preservatives which this naturalist has investigated, we find a very simple one, which he says, is very effectual for mammifera: the following is its composition:

| | |
|---|---|
| Cobalt in very fine powder, | 4 ʒ. |
| Alum, | 4 ʒ. |

"The same naturalist recommends another composition as very good, and which I think would be worth making a trial of for large animals, which would be very expensive done with arsenical soap. Very fat bitument is to be melted, in a strong solution of soap-water, until the whole forms a sort of clear broth; the interior of the skin is to be endued with this mixture, which costs very little.

"*Preservatives in Liquors.*

"Liquors are employed in baths, in lotion, in friction, in injection, and finally, in permanent baths, in which certain objects are always to remain; we shall now treat of these four methods of preservation.

"*Of the Bath.*

"In many animals, and particulary in the mammifera, the skin has such a thickness, such a degree of intensity, that the arsenical soap can not penetrate it sufficiently in order to preserve it perfectly; it is then that the bath becomes an indispensable operation. In penetrating the skin which is left to macerate a longer or shorter time, the preservative molecules with which it is saturated enters all its pores, and preserves it for ever from the attacks of insects.

"The following is the composition of the bath employed by the naturalists—preparors of Paris.

| | |
|---|---|
| ℞ Common water, | 5 ℔. |
| Alum, | 1 ℔. |
| Sea-salt, | ½ ℔. |

"This mixture must be boiled until it is all entirely dissolved, and when the liquor has cooled, plunge the skins into it; those of the size of a hare, or thereabouts, need not remain longer than twenty-four hours; those of the larger animals must macerate a longer or shorter time, according to their thickness; from eight to fifteen days would not be too long for a buffalo or a zebra. At the museum of Natural History of Paris, they very rarely make use of this composition; they are satisfied to macerate the skins in spirits of wine, which they keep in hogsheads for that purpose. Without attempting to criticise this method, which may have its advantages, we think that they might, perhaps, in this particular, follow the English naturalists, and add, like them,

a small quantity of corrosive sublimate dissolved in spirits of wine.

"Nevertheless, as we ought to be impartial, we should mention here the dangers attendant on the use of this terrible mineral, so much boasted by Sir S. Smith, president of the Linnean Society of London. When there is occasion to mount a subject prepared with sublimate, whether it has been employed in powder or in solution, in arranging the animal there arises a dust, which penetrates the nostrils, and may cause serious accidents. Arsenic, though much less energetic, is not even free from this inconvenience. Thus it is only with much precaution that preparors should handle preparations in skins which they receive from foreign countries, the substances used in the preparation of which they are ignorant.

"Let us now pass to the other preservatives in liquor, less generally employed, at the present time, although some of them may be very useful. The following is the tanning liquor which I have proposed in the Cabinet of Natural History:

| | |
|---|---|
| Tan, or oak bark, | 1 ℔. |
| Powdered alum, | 4 ʒ. |
| Common water, | 20 ℔. |

"An ancient author, the Abbe Manesse, composed his bath in the following manner:

| | |
|---|---|
| Alum, | 1 ℔. |
| Sea-salt, | 2 ʒ. |
| Cream of tartar, | 1 ʒ. |
| Common water, | 4 ℔. |

"Liquors employed externally as lotion.

"When an animal has been mounted or prepared, and fears exist less the insect should attack it, this may be prevented by washing its feathers, its hairs, or its naked skin, with one of the liquors which we are about to indicate. Animals exposed to the open air have, above all, need of being thus treated, and yet, by an inconceivable negligence, many amateurs permit their collections to be devoured, for the want of employment of a means both simple and easy.

"1. *The essence of wild thyme*, has been recently advantageously employed; in using it the feathers or hairs of an animal are to be raised every little distance by a long needle, and at their bases, that is to say, the skin, is to be touched by means of a hair pencil with a drop or two of the essence, and when this has been well imbibed, the hairs or feathers are to be replaced, their extremities, never being in contact with the liquor, cannot become tarnished.

"2. *Essence of turpentine* has been recommended by almost all authors, and yet, when made use of it is perceived with astonishment that great inconveniences result; it never dries upon the feathers, which it greases and soils in spite of every precaution, the spots spreading and enlarging like oil; besides this, it forms a species of glue, which arrests and fixes the dust in such a manner that no subsequent effort can remove.

"3. *Liquor of Sir S. Smith.*—This intelligent English naturalist, president of the Linnean Society of London, having turned his attention to the preservation of prepared objects, already classed in collections, has concluded that there cannot be a more

efficacious means employed than the following liquor.

| | |
|---|---|
| ℞ Corrosive sublimate, | 2 ʒ. |
| Camphor, | 2 ʒ. |
| Spirits of wine, | 1 ℔. |

"In large animals it is applied by means of a sponge, which is passed at different times over the whole exterior of the animal, until it is perfectly impregnated, and the liquor has penetrated to the skin. In small animals a hair pencil is used, and the operation is performed in the same manner. Whether the individual submitted to this practice be recently prepared, or whether it has long remained in a collection, it must be permitted to dry perfectly before placing it in a cabinet.

"In France this dangerous composition is replaced by the preservative in very small quantities diluted with water.

"4. *The bitter spirituous liquor*, recommended by other authors, is thus composed:

| | |
|---|---|
| ℞. White soap, | 1 ʒ. |
| Camphor, | 2 ʒ. |
| Colocynth, | 2 ʒ. |
| Spirits of wine, | 2 ℔. |

"The whole is to be subjected to cold infusion for several days in a vessel hermetically sealed, frequently shaking the vessel during this interval, and allowed to strain through unglazed gray paper; when it is thought that the infusion is done, it must be put into bottles equally well corked, and used after the same manner as the preceding.

"5. *Varnish* is employed only on the naked skin

of reptiles and fishes, to which it restores a portion of its splendour; it must be absolutely colourless, and perfectly transparent. In order to obtain it thus, it must be prepared by dissolving fine and new turpentine in spirits of wine, which must themselves possess the qualities above mentioned. It is to be applied with a pencil of squirrel's tail, or the tail of a martin, and the object is left exposed to the air, sheltered from the dust, if it be wished to hasten its desiccation.

"*Liquors employed in Injections.*

"Injections are more generally employed for the preparation of the eggs of birds, for which it is desirable to secure a long preservation; although by a very bad method, they have also been used for the desiccation of very small animals.

"In order to decompose the flesh of a fœtus already formed in an egg, recourse is had to a strong solution of a fixed alkali, of soda, of tartar, or to ether.

"*Liquors, in which objects are preserved which do not admit of drying.*

"The qualities which a liquor ought to possess, in which objects of natural history are placed, are, independently of that of preserving from decomposition: 1. to be colourless, that they may not tarnish the contained objects; 2. not to attack by corrosion the proper colours of the object; 3. to be perfectly transparent, that the contained objects may be visable through the vase which encloses them; 4. the power to resist frost, in order that they may not break the jar which holds them.

"1. Spirits of wine, of from fourteen to eighteen degrees of the areometer of Baume, appears to be the liquor which best fulfils all these conditions; the other alcohols, such as those from potato, from grain, from sugar, &c., have the same qualities; but a serious inconvenience is the high price of all of them, and this reason alone is an inducement to look for other compound liquors, capable of replacing them with more or less advantage.

"2. Nicholas recommends the following composition:

| | |
|---|---|
| Very pure water, | 2 ℔. |
| Alcohol, | 1 ℔. |
| Sulphate of alumine, | 6 ʒ. |

"The English naturalist, George Graves, in a work published in London, seven years ago, indicates a liquor which has much analogy with the preceding:

| | |
|---|---|
| Alum, | 8 ʒ. |
| Common water, | 1 ℔. |
| Alcohol, | ½ ℔. |

"The following is the method of preparing this mixture: the alum is pulverised and put into a vessel capable of resisting heat; water being heated to ebullition is poured upon the alum; when cool, it is to be filtered through gray paper, and then mixed with alcohol. The same author recommends another liquor, thus composed, but of which the mixture is made cold.

| | |
|---|---|
| Common water, | 1 ℔. |
| Alcohol, | 1 ℔. |
| Alum, | 12 ʒ. |

"4. The Abbe Manesse, after various trials, more or less successful, has published the result of his experiments; he proposes as the best liquor, one composed as follows:

| | |
|---|---|
| Alum, | 1 lb. |
| Nitre, | 1 lb. |
| Sea salt, | 1 lb. |
| Common water, | 4 lb. |
| Alcohol, | 1 lb. |

"The water used should be distilled, so as to be freed of any foreign matter; the alum should be the most transparent that could be obtained, and the salt also should be purified before use. The liquor may be made cold, but it is always better to boil it, with the precaution not to add the spirits of wine until it has cooled.

"All these liquors are inferior to spirits of wine, inasmuch as they are liable to freeze."

After having given this long list of the known means of preserving, and given in detail the representation of authors, it remains for us to judge of them, to determine their merit, and the degree of confidence that ought to be accorded to each, under the triple point of view of the preservation of objects of *normal anatomy*, of *pathological anatomy*, and of *natural history*.

1. *Process of desiccation.*—It can be of no utility for pathological anatomy, because it changes entirely the aspect and texture of parts, and in most cases it leaves no traces of the alterations which it is important to know. For normal anatomy, these preparations are, and always must be, from the sim-

ple fact of desiccation, a feeble resource, and really much inferior to the artificial subjects of M. Azoux; for this ingenious preparation, if it has many of the faults of dry anatomy, the objects are not so deformed as scarcely to be recognised.

Further, each of the preparations which tend to desiccation has its particular inconvenience: thus those of the deuto-chloride are numerous, as we have seen in the preceding chapter, and as have remarked in this the authors whom we have cited. We may add that the salts of mercury, of copper, and of lead, which, in combining with gelatine, form, it is true, an inalterable compound, have a great affinity for hydrosulphuric acid, and that there results from this affinity, a necessary deterioration of the objects, colouring them black. Sea salt does not possess durable preservative properties; and its affinity for water even facilitates the decomposition of the dried subjects which contain it. Alcohol is, doubtless, a good means, but it requires to be frequently renewed, until by its affinity for water it absorbs all which the organs contain; but alcohol costs *forty cents a quart, and loses always by evaporation*. Besides, parts thus prepared, are not less deformed than other dried parts, when subjected to desiccation.

The naturalist finds in the soap of Bècoeur, in other preparations containing arsenic, the deuto-chloride of mercury, alum, &c., sufficiently good means of drying or of tanning the skin and other animal tissues. But, as M. Boitard has remarked, these preparations are not without their inconveniences.

What have I to offer the anatomist who believes in the utility of dried preparations, to the naturalist whom a real necessity often forces to recur to them? My liquid, employed as a bath or injection, without either danger or inconvenience, and *which costs only two or four cents the quart.*

I shall give here an example of injection; a corpse is injected by the carotid with from five to seven quarts of the acetate of alumine at 20°, and containing in solution about two ounces (fifty grammes) of arsenic acid. Four days after this injection, if it is intended to prepare the large and small vessels, inject by the aorta half a quart of a mixture, equal parts, of the essence of turpentine and essence of varnish; finally, make a single cast of a hot injection of a mixture of suet and of rosin, in equal parts, coloured with cinabar for the arteries, and with a black or blue colour for the veins. Then, the corpse, or the part of the corpse which it is intended to preserve, is prepared and dissected at leisure, according to the wish of the operator.

When the body has been injected, as above described, the preparation which is made of it easily dries in the open air from the month of May to the month of October; during the winter it is necessary to deposit it in an oven, or in a heated chamber. When the desiccation is slow, or the moisture is excessive, the byssus sometimes developes on its surface, but this may be washed off, and a layer of varnish will prevent new vegetations. This preparation will be certainly superior to any contained in cabinets of anatomy.

In support of this assertion, I will cite an au-

thentic fact, that of a woman whose body was submitted to the examination of the commissioners of the Institute and of the Royal Academy of Medicine, appointed to prove the value of my process.

On the 10th of May, 1834, a woman died in the wards of M. Majendie, at the Hôtel-Dieu; the body was injected the next day with the acetate of alumine, at the termination of this operation, it remained fresh until the 15th of January, 1835, when it dried without experiencing any alteration. The commissioners of the two Academies made experiments upon this body, at different periods. On the 15th of January, 1836, M. Guèneau de Mussy, to assure himself of the state of the cerebral substance, demanded the head to be opened, I profited by this occasion to *take off the hairy scalp.* The same day, M. Breschet, desiring to know what would result from the exposure of this corpse to the open air, it was suspended beneath the shed of the dissecting rooms (école pratique.)

Ten months after, in the month of November of the same year, it had not experienced any alteration. At this period, M. Gaucherant, inspecting overseer of the école pratique, wishing to terminate the experiment, the body was sent to the cemetery.

*The right arm and forearm*, the only parts remaining untouched, after the experiments of MM. the commissioners, were *amputated by myself.* I preserve this piece, as well as the hairy scalp; I can show them to anatomists to be compared with all the preparations obtained by other processes; none of them, I am convinced will be pronounced comparable to mine. The hairs remain so firmly attached to the

scalp, that a strong pull will not detach them; I am quite sure that the injection has penetrated even to the capillary tubes of these organs; my experiments upon cats, dogs, and birds, have demonstrated the penetration of my liquid into the horny organs, hairs, or feathers, which clothe the skin of these animals. These facts will demonstrate all the services which it is capable of rendering naturalists. Finally, no process of tanning could give to the internal surface of the skin an aspect more satisfactory than that which offer other preparations deposited in my cabinet

2. *Preservation in liquids.*—The different preservative liquids produce effects very different from the process of desiccation; however, all those employed up to the present day, possess serious inconveniences, as any one may be convinced by reading the very commendable passages which we have extracted from the pamphlet of M. Dumèril. We shall point out some others which he has omitted.

(*a.*) *Nitric Acid*, the only one of all the acids, that can be of any use to the anatomists, preserves well, it is true, the preparation of the nerves, hardening their structure, and increasing their nacreous white colour; but it deteriorates all the other structures, it dissolves the gelatine, softens the muscles, and deprives the bones of their calcareous salts; it cannot be other than deleterious to objects of pathological anatomy, and natural history.

(*b.*) *Alcohol*, is more servicable than any other liquor in use, but its high price renders its employment almost impossible for objects of normal anatomy; it hardens and sensibly alters objects of pathological anatomy; and these alterations, however

trifling they may be, and unimportant to regular anatomy, are serious for the physician, who cannot have too exact an idea of the progress of disorganization in the living tissues. If alcohol is eminently useful for natural history, its costliness renders it impossible to extend the use of it as far as the interest of science demands.

*c. Diluted Alcohol,* to which is added the deutochloride of mercury, is a less expensive liquor; it preserves accurately enough the labours of the naturalist and anatomist, but it is not sufficiently faithful for a pathological anatomy. The same may be said of the hydro-chlorate of soda, the hydrochlorate of ammonia, the muriate and nitrate of alumine added to alcohol.

*d. Alum,* which we have seen figure in many of the adopted formulæ, is, nevertheless an unprofitable means of preservation. Extensively used in commerce, and employed from time immemorial in dyeing, it has only recently attracted the attention of preparers. This salt, to which the new chemical nomenclature has successively assigned the names of *double sulphate, triple sulphate, acid sulphate of alumine and potash;* has been experimented upon by myself, and has not answered my expectations. I have investigated the cause of this failure, and think I have found it; in analysing this compound, for every hundred parts I have obtained

| | |
|---|---|
| Sulphate of alumine, | 36.85 |
| Sulphate of potash, | 18.15 |
| Water, | 45 |
| | 100 |

One hundred parts of this salt contains 10.86 of alumine. At the temperature of 12° centigrade, five hundred grammes of water dissolves thirty grammes of salt, from whence it results that a pound of water contains in solution only eighteen grains of alumine; from whence I have suspected that the little efficacy of alum for the preservation of animal matter, depends on the too small quantity of alumine in the solution. A fact convinced me that I was right: twenty-four hours after the immersion of a corpse in a bath containing the acid sulphate of alumine, I have observed that all the alumine was absorbed by the animal matter. Finally, the experiments which I have tried with the salts of alum, more rich in alumine, and more soluble in water, and the happy results I have attained, authorizes me to say: alum is a bad means of preservation, *because it is not sufficiently soluble, and does not contain enough alumine.* The reader will naturally again recur to the subject when we come to the exposition of my researches.

### SECT. 3.—*Means of preservation applied to each tissue.*

In our first paragraph, we have passed in review the different preparations which ought to precede the application of preservative means; in the second, we have seen these numerous means, and we were compelled to deliver an impartial judgment. It remains for us to explain here how anatomists have applied them to the tissues taken separately. We shall abstain from relating the preparations which precede the application of preservative means,

because they are foreign to the subject which occupies us, and would uselessly prolong a discussion already too much extended.

1. *Fibrous tissues.—Articulations, aponeuroses, tendons, and ligaments.*—The process generally adopted is due to M. J. Cloquet, in nearly following the method employed by the tanner, he has succeeded in preserving the suppleness of these tissues.

"The following," continues he, "is the process which I have adopted.

"Dissolve four pounds of muriate of soda and a pound of alum in ten pints of water: the articulation, which has been carefully dissected, must be allowed to macerate fifteen or twenty days in this lie; paying attention to move it frequently in the solution, to press and twist its ligaments, and, above all, to strike it lightly with a little mace of light wood. These manœuvres are intended to render them pliable, to separate the fibres, which permits the salts to penetrate more easily. Withdraw the articulation from the solution, dry it for four or five days, taking care to move it occasionally, and still to strike it with the little mace; then put the articulation into a very concentrated solution of soap, (a pound to three pints of water,) handle, and strike it again for seven or eight days, the time necessary for divesting it of salt, and permitting the soap to penetrate the ligamentous fibres, to take the place of the salts. At the end of this time, that is to say, thirty-six or forty days after the commencement of the operation, wash the articulation in a weak lie of carbonate of soda, (an ounce to two pounds of water,) after which it is to be dried.

"By this process, which may be modified in various ways, ligament may be obtained perfectly supple, of a yellowish or grayish colour, resembling chamois leather, very resisting, and permitting the joints to execute their ordinary movements.

"I have prepared, in this manner, the articulations of the shoulder, of the knee, of the fingers, and of the vertebral column. I repeated my experiments with the intention of obtaining a more expeditious method.

"The articulations may also be preserved perfectly supple, by keeping them immersed in a mixture of equal parts of olive oil and essence of turpentine.

"2. *Osseous tissue.*—The different preparations to which bones are subjected in order to preserve them, are maceration or ebullition, and then bleaching.

"*Maceration.*—When it is desired to obtain the bones very white, it is necessary to choose, as far as possible, a thin or infiltrated corpse, of an individual of from thirty to forty-five years, or thereabouts, dead of some chronic disease which has not altered the structure of the bones. Consumptive bodies are the most proper for this kind of preparation. The subject being chosen, it is roughly stripped of its muscles and periosteum; the sternum is to be detached by dividing the costal cartilages where they join the ribs; the members are to be separated from the trunk, in order that these various parts may be more conveniently placed in a trough, which is to be filled with water, and disposed in some place where the putrid emanations cannot produce any in-

convenience; the bones must be constantly kept covered with water, which must be renewed every four or five days in the commencement, and at more prolonged intervals towards the end of the maceration.

"The anatomist should watch over these macerations; and it is only when all the fibrous parts separate easily from the bones, or the inter-vertebral fibro-cartilages, and the yellow ligaments separate readily from the vertebra, that the skeleton should be withdrawn from the bath and cleaned. For this purpose, he collects with care all the pieces, and places them in clean water; he cleans them by removing with a scalpel the fibrous parts which may yet adhere, and by rubbing them under water with a very coarse brush; he then places them on coarse linen to dry them.

"*Ebullition.*—Boiling water is often resorted to for preparing the bones of the skeleton. After having roughly separated them from the soft parts, they are placed in a kettle of water, and subjected to ebullition for six or ten hours, according to the subject. The action of the water is increased, and the fibrous parts more accurately stripped from the bones, as well as the grease, by placing in the kettle, an hour before the end of the operation, potash, or soda of commerce, (sub-carbonate of potash, and of soda,) one pound to eighty or a hundred pints of liquid. After having carefully removed the grease which swims on the surface of the water, the bones are to be withdrawn and plunged into a new alkaline lie, warm and very weak; clean them with care, as in the preceding case, separating exactly

from the articular surfaces, the swollen and softened cartilages, which remain adhering to them: the bones being clean, they are to be washed frequently previously to drying.

"In employing ebullition, we have the advantage of preparing the bones more promptly, and in a manner less insalubrious than by maceration. Nevertheless, this mode of preparation has its inconvenience: 1. Bones which are boiled, become, in general, less white than those which are macerated; the blood coagulating in their pores, leaves a brown tinge, which it is often impossible to remove; 2. They commonly retain a greater quantity of medullary matter, which, by becoming rancid, soon gives them a yellow colour and a very disagreeable odour; 3. Ebullition is not applicable to the bones of young subjects, in which the epiphyses are not yet adherent; it acts upon their gelatinous texture, and despoils, in part, the short bones and the extremities of the long bones of the compact layer which envelopes them. This last inconvenience is manifested even in the bones of adults.

"*Dealbation, or bleaching of bones.*—In order to obtain macerated bones perfectly white, several processes are employed: 1. The best method consists in placing them upon the grass exposed to the united action of the air, the sun, and the dew, as is practised in bleaching linen, wax, &c.; care is to be taken to turn them every fifteen days, in order that they may bleach equably; two or three months of such exposure is sufficient, particularly during the spring, to give them a brilliant whiteness. 2. The bones may be exposed to the action of chlorine,

either liquid or gaseous. In the first case, they are to be plunged three or four times daily in a lie which holds chlorine in solution, repeating this operation for ten or twelve days; in the second, they must be steeped in water, placed on a hurdle and covered with cere-cloth or gummed taffeta, they are then to be exposed over an earthen pan, in which has been placed suitable proportions, of muriate of soda, oxide of manganese, and sulphuric acid: from time to time this mixture is to be slightly heated. 3. In place of gaseous chlorine, the vapour of sulphuric acid may be advantageously employed, as is done in the arts of bleaching wool, silk, &c.; sulphur is slowly burned beneath the hurdle, upon which has been placed the moistened bones; the alkaline lies may also be used for the bleaching of bones although they do not appear to me so advantageous as the preceding means.

"3. *Cutaneous tissues.*—Deprived of grease, and of subjacent cellular tissue and exposed to the air, this tissue inclines to dry. The human skin may be prepared by the aid of several processes analogous to those of tanners and leather dressers. A lie has been recommended composed of two pounds of common salt, four ounces of sulphate of iron, and eight ounces of alum, melted in three pints of almost boiling water; the skin divested of its grease, is plunged into this solution, agitated for half an hour, and macerated for a day or two in this liquid; the lie must be frequently renewed, then the skin is to be withdrawn from the bath and dried in the shade.

"4. *Cellular tissue.*—Authors have successively employed desiccation, insufflation, tanning liquors

and alcohol, for preparing the cellular tissue; although the method given by them as preferable, is the preservation in an aqueous solution of nitrate of alumine, to which is added a small quantity of spirits of wine.

"5. *Synovial and serous tissues.*—The first is much more easily preserved than the other; an accurate dissection, expulsion of the synovial liquor, kneading, and desiccation, are the means used; the operation is finished by the application of a preservative varnish. The same practice is applied to the serous tissues, but with less success; its proximity to organs eminently putrescible, such as the brain, the lungs, the liver, renders its dissolution more imminent, more difficult to prevent.

"6. *Encephalon, spinal marrow, nerves.*—We have already spoken of the property of nitric acid, to give consistency to the nerves, without causing them to lose any thing of their pearly whiteness. Anatomists generally avail themselves, for the preservation of the whole nervous system, of the alcoholic solution of corrosive sublimate. After twenty or thirty days immersion in the bath, these organs are withdrawn and exposed to dry. As communicating a remarkable density to the encephalic mass, a solution of sugar in brandy is much praised: it is a method recommended by Lobstein, chief of the anatomical department of the Faculty of Strasbourg.

"7. *Arterial vessels, veins, and lymphatics.*—The interesting details which have been furnished to us by the pamphlets of M. Dumèril on the subject of injections, will enable us to dispense with much further developments; the vessels injected and pre-

served, as we have seen, are dried and preserved in alcoholic liquors.

"When the object is to prepare the vessels of the bones, some care is exacted to render visible their passage through the bony frame; after having filled the vessel with a coloured injection, the piece is to be placed in a diluted mineral acid, which, in dissolving the calcareous phosphate, leaves the vessels in position, and clearly visible through the gelatinous portion of the bone.

"In causing this mucous body to dry slowly and in the shade, it will acquire the necessary transparency to manifest on its cut surface (endued with volatile oil and varnished) the distribution of the vessels which penetrate the bones. These pieces may be preserved in a collection, either in the open air, after having been plunged into an alcoholic solution of arsenical soap, which dries quickly without bleaching; and to which essence varnish adheres very well; or if the piece is small, it may be suspended in a jar of volatile oil, luted with care; in this latter case, the injection must have been made with gelatine, and not with fatty matter.

"8.-*Muscular tissue.*—The process of Swan, or rather the discoveries of Chaussier, furnish the means of preserving the muscles by desiccation. Nevertheless, another method is recommended by authors; after having prepared the vessels and the muscles, the preparation is to be placed in a mixture of alcohol, lavender, and essence of turpentine; it is to be left for several days in this liquor, and then exposed to a warm and dry air; when desiccation is complete, a layer of varnish may be applied.

"9. The preservation of particular organs, such as the *heart*, the *lungs*, the *eye*, &c., differ but little from that of the organs which we have just mentioned; they are always to be either dried, or deposited in an alcohol bath. The lacrymal ways, says M. Breschet in his excellent thesis on the preservation of anatomical subjects (Paris, 1819,) are less easily preserved, although the lacrymal sac, nasal canal, the lacrymal points and conducts, offer more difficulty in their preparation than in their preservation, which may be accomplished by liquors, or by desiccation. The lacrymal canal, and its excretory canals, can only be seen on preparations in spirits of wine. Finally, the following are some passages from the same work, upon the *means of preserving the embryon and the fœtal envelopes*.

"It is useful to preserve the embryons and fœtuses at different periods of gestation, in order to study the successive development of each organ.

"The egg, considered in its various periods of incubation, can only be preserved in alcohol somewhat weakened, in order that it may not harden the membranes. Kirschwasser, in which has been dissolved the nitrate of alumine, forms a limpid liquor, in which the egg may be preserved without any alteration. In order to demonstrate the development of these organs, many parts may be injected; thus, during the earlier periods, the pedicle of the umbilical vesicle admits mercury, which is introduced by a small glass syringe, the tube of which has been drawn fine in the blow-pipe: this injection ought to be made on the side of the vesicle, and sometimes the metal may be seen passing into the intestines.

"The omphalo-mesenteric vessel ought also to be injected. The urachus should be opened, and its communication with the bladder should be shown on one part, and with the alantois on the other. All these parts are to be kept separate from each other, and attached by means of small pins to a plate of wax. In the fœtus, near the term of gestation, those vessels which establish the communication between it and the mother, are to be injected.

"The bones of the embryon, after having been injected, are to be placed in oil of turpentine, without its being necessary previously to place them in a weakened acid.

As regards the envelopes of the fœtus, and the placenta which it may be intended to preserve after an accouchment at full term, injections of different colours are forced into the umbilical arteries and veins; this injection should not be too delicate, or pushed with too much force, otherwise it will pass from one of the vessels into the other. These two parts should be allowed to soak some time in an aluminous water, or, what is better, in a sublimated alcoholic solution, then place a hog's bladder in the cavity of the membranes, blow up the bladder, and thus expose the parts to the air for desiccation; after which the bladder is to be withdrawn. The membranes, with the placenta, may thus be preserved, by placing the uterine face of the latter sometimes within sometimes without the cavity of the membranes. These same parts can be preserved in liquors. Finally, some persons make use of the method of corrosion to prepare and preserve the placenta."

It is useless to advance here new observations; those which have been already presented on the occasion of preservation, considered in general, are equally applicable to the present. It will be perceived in the following chapter what means I propose to substitute for them, as meriting the preference.

# CHAPTER VIII.

## GENERAL PROCESSES FOR THE PRESERVATION OF OBJECTS OF NORMAL ANATOMY, PATHOLOGICAL ANATOMY, AND OF NATURAL HISTORY.

### EMBALMING.

A PORTION of my researches has been submitted to the examination of commissioners, appointed by the Institute, and by the Academy of Medicine.

After long and repeated experiments, MM. the commisioners, have been unanimous upon the utility of the processes of preservation which I propose, and in particular my process for the preservation of subjects for the amphitheatres, the only one for which it was important for me to obtain a definite sanction, recommended by the Institute, is applied to the dissecting rooms of Clamart, with a success that every one may witness.

The faithful and complete exposition of the numerous trials which I have attempted, will furnish me, in this chapter, the occasion of indicating the most efficacious means of preservation for objects of pathological anatomy and of natural history. And, as it is incumbent on a man of study, disinterested in all that concerns science, I will give publicity to the result of my labours, the composition of the different liquids, and the mode of using them.

As for my process of embalming, I have thought

that it ought to remain my property, and that one exclusively addicted to chemical studies was more qualified than the physician to subject it to those modifications which each particular case requires.

I have secured a patent of invention; for my method differs essentially enough from the preparations which I indicate for the purposes of anatomy.

It is necessary, in effect, to preserve to the tissues in embalming, a freshness and suppleness which is lost by desiccation, at the end of some months, in the subjects injected for the use of the anatomist; it is necessary, above all, to secure to the body, in this latter case, a more prolonged preservation: the facts which I can show, will prove that I have attained my end.

### 1.—*Preservation of bodies for dissection.*

My experiments upon gelatine have conducted me to the knowledge of some one of the constituent parts of different animals. I had studied the action of chemical agents habitually employed in the arts; the labour of the tanner, or leather dresser, of the parchment maker, the fabrication of glue, which I have practised on a large scale from 1819 to 1828, have equally furnished me with valuable data.

In 1826, my attention having been arrested by MM. Bègin and Serrulas, on the preservation of objects of pathological anatomy, trials were made at the Val-de-Grace.

In 1828, M. Alphonse Sanson, disposing himself to prepare a cabinet of anatomy, at the request and for the use of some English gentlemen, proposed to me to occupy myself with the question relative to

preservation, which obliged me to make some researches; but it was not until 1831, and at the solicitation of M. Strauss, an anatomist of well known merit, that I undertook serious and continued labours upon the preservation of bodies. From this moment, I employed all my attention and cares to resolve this question.

The researches on the preservation of bodies demanded the re-union of different circumstances, without which it would have been impossible for me to have attained a satisfactory solution. It is easy to conceive, in effect, the great difference which ought to exist between the action of any given liquid upon some scruples of animal matter, and its action on an entire corpse; I ought to confess, also, that without the extreme courtesy of M. Orfila, who placed at my disposition, at the practical school of the faculty of medicine, all the objects of which I might stand in need, it is probable that it would have been impossible for me to have arrived at positive results. I encountered some difficulties, some resistance, and even something more, on the part of some scientific notables, and also of some ambitious subalterns; but I have surmounted all.

This work on the preservation of bodies ought only to be considered as the suit of that in which I have treated of the preservation of alimentary meats. It is only the circumstances of which I have just spoken, that have determined me to finish this work sooner.

It is well known that the study of medicine should be preceded by the study of anatomy, which teaches the knowledge of the organization of the human

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body; but this study is difficult and presents numerous dangers. The study of the organs exacts time; their dissection is tedious, especially if intended for demonstration. In this case it almost always happens that putrefaction seizes the subject before the preparation is finished; for, at a temperature above fifteen degrees, it is impossible to preserve a subject more than six days; under this temperature, that is to say, from 0 to 10 degrees, the longest time one can disssect is twelve or fifteen days. But the corpse always exhales mephitic miasmata before all the organs are putrefied, and this emanation of gas is certainly the cause which most frequently determines typhus fever, so destructive to a portion of our studious youths.[1]

Before exposing my own researches upon the preservation of bodies, it was necessary to examine the researches anterior to mine; it will have been perceived by what precedes, that they were of no service to me.

Thus, in viewing all that has been effected on this matter, I can find no indications excepting the processes employed in the arts.

In our works of chemistry applied to the arts, I have often been able to prove, practically, that muscular flesh, perfectly isolated, easily dries. When it is mixed with gelatine, it easily experiences, on the contrary, putrid fermentation. Geline[2] is the

[1] Out of ten medical students lodging together, and frequently of the same amphitheatre, nine were attacked by this grave malady in the course of last year, and three of them died.

[2] Up to the present, certain animal substances have been considered chemically identical, which are not so: 1, the proper matter of gelati-

animal matter, which, all circumstances being equal, putrefies the easiest; and which, forming the organs of animals, experiences an alteration more or less prompt, according to the prevalence of a greater or less quantity of water of composition present. Always, then, when we succeed in preserving from putrefaction this animal part, the other parts will be disposed to desiccation. My researches have conducted me to this conclusion.

In order to find a method of preserving bodies, and animal matters in general, it was essential to examine the action of chemical substances to which may be attributed properties which produce upon the constituent parts of these matters an immediate action; it is necessary also, that they should be easily procured, and that they be of a moderate price. I am satisfied that acids do not preserve animal matters; they disorganize them more or less promptly, in direct proportion to their concentration. Many weak acids, among others hydrochloric acid, at five degrees, may be employed to dissolve the calcareous salts from the bones; nitric acid also, at five degrees, may be brought into use in some particular cases; for example, when it is wished to study the nervous system; but then the bones are softened, the geline is in part disorganized, the mus-

nous tissues not decomposed; 2, the product which results from their decomposition by the action of heat and water; 3, this same secondary product dried. These three compounds were designated by the denomination of gelatine. As I have proved that there is not between them any identity of character, I have named gelatine the animal matter contained in the gelatinous tissues; I have reserved the name jelly to the product of the decomposition of geline, and I have left the name gelatine to glue, whatever may be its purity.

cles are discolored, and become flabby, as well as the viscera; the nerves only remain of a pearly blue, strongly pronounced.

Arsenic acid has a very marked action on animal matters; I shall make it known without delay in my second memoir upon gelatine. It preserves bodies well, but appears to favour their desiccation. In the details of experiments made under the surveillance of the commissioners of the two academies, I shall cite the effects produced by the employment of this substance. Acetic acid preserves flesh only by drying it. This acid weakened, or vinegar, retards putrefaction, softens the bones, as well as the muscles, which are discolored by its action.

Concentrated lies dissolve all animal matters; weak alkaline solutions disorganize more or less promptly the same substances.

A very small quantity of alkali suffices, when warm, to decompose very large masses of glue. This effect is often produced through ignorance in the manufacture of strong glue.

Salts only preserve meats when employed dry, or in very concentrated solutions; it is necessary that their affinity should be sufficiently great to absorb all the water of combination of animal matters. It may be then affirmed that salt only preserves meat by drying it; thus those salts more soluble in warm than in cold water; may, when injected warm, in a saturated solution, be considered as a good means of preservation, but which cannot be employed for anatomical purposes, because of the crystals which form in the organs during the cooling of the injected liquor.

Salts with a metallic oxide base have in general little affinity for geline, and do not preserve well; those which are poisonous being alone excepted. The salts of copper, and above all those of mercury hinder putrefaction; but many causes are opposed to their employment.

1. Their action is not sufficiently energetic to give them the preference: 2. they are always dangerous when employed in large quantities. 3. They are very injurious to dissecting instruments. 4. In fine they are too costly.

The aluminous salts are those alone which I find possessed of the property of preserving animal matters; their bases combine with geline to form a particular compound, the acid being set free.

The vegetable kingdom furnishes but few products capable of preventing or retarding putrefaction; alcohol is nearly the only substance possessing the property. It preserves in the same manner as the salts, by imbibing a portion of the water of composition; it bleaches, discolours, and hardens the organs. Alcohol is the only substance employed up to the present for preservation; but its action upon the tissues, its extreme volatility, the difficulty of transporting it, and its extreme dearness, makes another process desirable.

Tannin cannot be employed, because water does not contain enough of it in solution to render an injection of it preservative; a corpse immerged, even in a great mass of tannin, is no better preserved, the skin is tanned, but the flesh decomposes.*

* Entire bodies of both men and horses have been found not unfrequently, preserved for centuries in the English bogs—which preserva-

Gallic acid acts in the same manner, but yet more feebly than tannin.

An oily, volatile, and very odorous substance, recently discovered, and to which the name *Creosote*, has been given, has been presented as a universal panacea, which, among other properties, ought to possess that of well preserving bodies. In order to assure myself of the truth of this assertion, on the 18th October, 1835, I injected a subject with one hundred scruples of creosote, dissolved in seven quarts water. On the 23d, the abdomen was very much swollen, and of a very strongly pronounced blue-green colour; on the 26th, the left side of the face, the right arm, and all of the left leg, were green; on the 30th of October, putrefaction was so much developed that it became necessary to bury the body. It may be objected, that the subject should have been at the same time steeped in a bath saturated with this substance; but its high price discouraged me from making such an experiment; besides I think that the odour of the creosote will always prove an obstacle to its employment.

Alum, the acid sulphate of alumine, and of potash, have given me the first good results; but, slightly soluble when cold, they will not suffice when the atmospherical temperature rises above fifteen degrees, (cent.) A mixture of alum, of chloride of sodium, (common salt,) and of nitrate of pot-

tion has always been referred to the tannin in its fluid portion. These instances probably occurred at a low temperature. I have tried the experiment by immersing small quadrupeds in a saturated solution of powdered nut-galls, during warm weather, but always found it insufficient for preservation from putrefaction.—*Tr.*

ash, has succeeded better with me. I have tried the action of sulphate of soda, of chloride of calcium, (muriate of lime,) of hydrochlorate of ammonia, &c.; they were almost useless.

The mixture of two parts of alum, of two parts of salt, and of one part of nitre, in a sufficient quantity of water to mark the liquor at ten degrees, injected, preserves bodies very well bathed in the same liquor, but only when the temperature is under ten degrees 0|0 for a more elevated temperature it is necessary to warm the liquid, and add the salt mixture until the areometer marks twenty-five or thirty degrees.

Of all the saline substances which have given me satisfactory results, the aluminous deliquescent salts are to be preferred. The acetate and chloride of alumine have perfectly succeeded with me. In fine, a mixture of equal parts, of chloride of alumine at twenty degrees, and of the acetate of alumine at ten degrees, may be considered, employed in injection, as a good method which we now possess for the preservation of bodies.

Now that I have explained the action of chemical agents upon animal matters, I shall enter upon the details of experiments.

I presented my work to the Institute on the fourth of March, 1833. The Academy of Sciences named for its examination, a commission composed of MM. Savart, Flourens, Chevreuil, and Serres, reporter. A few days after, M. Serres placed at my disposition, at the Hospital La Pitié, and in his private cabinet, a corpse, which I bathed in a tub containing a solution at ten degrees, two parts of alum, two

parts of common salt, and one part of nitre. This subject, repeatedly examined, appeared to be well preserved. At the end of about six weeks it was opened; the flesh and the viscera were in a good state of preservation, but particular circumstances put an end to this examination.

On the twelfth of November, 1834, the administration of Hospitals presented two subjects to me, which M. Orfila authorized me to place in one of the grand pavilions of the practical school of the faculty of medicine. These two subjects were bathed in a liquid of ten degrees. The second of December the commission of the Academy of Sciences came to examine these two subjects, which were consigned to dissection. On the same day another subject was given to me. This was injected with eight quarts of the saline solution at ten degrees. At the end of December, these three subjects were in a good state of preservation; it was remarked, however, that the skin as well as the flesh, had slightly assumed a decayed consistence and colour; the deep organs, which had not been in immediate contact with the liquid, remained almost natural. From this period until the end of April, the commission frequently assembled and confirmed these results.

A commission constituted by the Academy of Medicine early in March, examined these same subjects, and demanded new experiments. The first subject was injected with coloured fat, and then bathed. The corpse injected on the second of December, was also injected with coloured fat.

Here it may be remarked that it required double

the quantity of fatty matter for this, than for a fresh subject, and that the most delicate arterial net-work had been prepared by the injection.

These experiments, which lasted for half the month of May, satisfied me that an injection of ten or twelve degrees of density, and immersion of the body in a bath of the same liquid, will suffice for a preparation destined for ordinary anatomical purposes, and will allow of dissection after several months.

At the end of July, 1835, M. Orfila, placed at my disposition in one of the grand pavillions of the practical school, all the utensils and instruments that I might stand in need of; on the 7th of August, I injected a subject with the liquid at 12 degrees, and afterwards bathed it in the same liquid. The body, at the end of two days, began to swell. Eight days after, it disengaged so large a portion of gas, that I was obliged to withdraw it from the trough, at the bottom of which it was no longer possible to retain it. Placed upon a table, its decomposition appeared to be arrested, no more gas being disengaged, but there escaped a great quantity of liquor coloured by the blood; the subject, which had assumed a deep brown colour, became completely dried. During all this time, no putrid odour was remarked; it was that of smoked ham.

A second subject was injected with the same liquid and abandoned on a table; it was decomposed at the end of five days; but it must be remarked that the atmospherical temperature varied from twenty to thirty degrees.

On the 8th of August, a subject was injected with

the liquid at thirty degrees of density, which was made necessary by the elevation of the temperature up to fifty degrees 0|0. This corpse was well preserved and was dissected about the end of December.

These various experiments convinced me that the saline solutions employed with success during the winter, were insufficient for the operations during summer; that is to say, at a temparature above fifteen degrees.

The success which I obtained by the injection of a more concentrated liquid, indicated the route I was to follow.

I have already stated that the alum was decomposed, that the animal matter, the geline, combined with the alumine, and that the liberated sulphuric acid produced the alteration of the tissues. It was then indispensable to seek an aluminous salt, containing more of the base and a less powerful acid.

On the 16th of August, I injected a subject with eight quarts of acetate of alumine at twenty degrees. This corpse, placed upon the table without any other preparation, was preserved perfectly well for the period of one month; at the end of this period, it might be perceived that the nostrils, the eyelids, and the extremities of the ears, commenced drying, as well as the hands and feet. In order to remedy this inconvenience, I covered one half the subject with a layer of varnish. At the end of two months, it was easy to remark, that the part subjected to the action of the air had considerably diminished in volume, and was less useful for dissection. Finally, at the end of January, 1836, the varnished parts,

not dissected, were still well preserved, whilst the rest was completely dried, mummified.

Dr. Piory had indicated to the Academy of Medicine a method of preserving bodies: it consisted, according to him, in enveloping the body in layers of pewter, and of linen, and then of varnish. This process perfectly succeeded with me on a subject injected with acetate of alumine.

Another subject was injected with the chloride of aluminium. This injection did not succeed well, and with three bodies I met with the same difficulties, that is to say, the liquid contained in the syringe having been introduced after the space of time allowed for refilling it, the circulatory system had become so obliterated that the force of even two men was not sufficient to introduce an additional quantity. At twenty degrees the chloride of aluminium has so great an affinity for water, that it absorbs that of which the organs are constituted. However, the parts of the body which had been penetrated by the liquid were well preserved, the muscles in particular had preserved their colour.

I injected another subject with the chloride at eight degrees, but, at the end of a month, it was decomposed. Finally, I introduced a quart of chloride at ten degrees, and six quarts at twenty degrees; this subject was preserved, but the parts not dissected were dried at the end of five months.

A mixture of three quarts of the acetate of alumine at ten degrees, and of three quarts of the chloride of aluminium at twenty degrees, injected by the aorta, or better still, by the carotid artery, have afforded the most satisfactory results.

I have already remarked that all these experiments were made under the inspection of the commission appointed by the Academy of Sciences, of those of the Academy of Medicine, and of the Monthyon commission, composed of MM. Dulong, Magendie, Darcet, and Dumas, reporter. The account which these commissioners have rendered to the two Academies, renders it unnecessary to present here a summary of my experiments.

These gentlemen requested me to repeat the experiments of Doctor Tranchini, of Naples, which consists in injecting a solution of two pounds of arsenic in twenty pounds of clear water, or better, in spirits of wine.[1] During eight days the corpse remained perfectly natural; but after this time it gradually dried, although deposited in a damp situation, and along side of a water cock, kept running.

It was injected on the ninth of September, and examined on the twenty-fifth of the same month; but, on the same day, having offered it to several students for dissection, none of them were willing to accept of my proposition.

On the sixteenth of October, it was found unfit for any anatomical purposes; on the thirtieth it was completely dried.

I think that the employment of this method presents real dangers for the anatomist, of which the following is a proof: Doctor Poirson declared before the Academy of Medicine, that he had been exceedingly incommoded, as well as two of his col-

[1] Arsenic is so little soluble, even in warm water, and, above all, in alcohol, that I introduced the liquid saturated, holding in suspension more than one-half of the powder which could not be dissolved.

leagues, in having embalmed two generals with this substance; he attributed this derangement of his health to the arsenic absorbed during the preparation.

I drew the attention of the commissioners to the fact, that the table upon which the body lay, that the windows of the room, and that the corpse itself, were covered with dead flies; a considerable mass of them was observed on the opening made in the sternum. I thought that this effect might be attributed to the evolution of arsenical hydrogen; this evolution is, at least, probable, and the action of this gas on the animal economy can well be conceived.

Finally, when we reflect that there are always more than eighty bodies under dissection at the Practical School, and that, consequently, it would demand one hundred and sixty pounds of arsenic to be put at the disposition of each student, it will readily be conceded that this process would not be applicable.*

At this period of my labour, I had already proved that the methods by which I had obtained favourable results in principle, became insufficient when exterior circumstances changed; that the salt of alumine, which I made use of in my injections, was

* In the autumn of 1837 I tried this experiment of Tranchini, on the body of a patient who had died the day before with consumption, in the wards of the Philadelphia Hospital. A saturated solution of spirits of wine and arsenic, coloured with carmine, was injected into the carotid artery,—the countenance regained its natural fulness and complexion, which state continued for about three weeks, with the exception of some shrinking of the eyes. In about six weeks the corpse began to mould, and the skin of the legs could be scraped off,—the body was then buried.—*Tr.*

not sufficiently rich in alumine; that the preservation was not certain above a certain degree of temperature; finally, I had found in the acetate of alumine a suitable matter for forming injections eminently preservative.

It was then that the reports were read to the Institute and Academy of Medicine. I cite them because they prove, in an authentic manner, the point which I have attained. It was already possible, with these data, to dissect during all seasons, without fearing henceforwards the dangers attached to this employment during the heat of the weather.

INSTITUTE OF FRANCE.—*Academy of Sciences—Public sitting of Monday, 28th of December, 1835—Prize relative to the means of rendering an art or a trade less unhealthy—On the preservation of dead bodies, by* M. GANNAL.

Your commission have followed with interest the experiments of M. Gannal; it has availed itself of the experience of those of our confrères whose studies oblige them to practise daily dissections, and it believes itself authorized to declare to the Academy, that the means pointed out in the first place by M. Gannal, and that, which is still better, the simple injections of acetate of alumine, at ten degrees of the areometer, which he practised at a later period, answers for preserving bodies for several months, even during the summer. It is assured that no inconvenience results from it in dissections.

Your commission has thought it proper to wait until this process should be regularly practised in

some amphitheatre of considerable extent, before pronouncing on it in a definitive manner. It is aware how difficult it is to introduce the most simple improvement into routine operations, because, against the employment of them there arises numerous unforeseen obstacles.

It remains convinced, however, that this process may render, even now, real services in all countries where dissection meets with difficulties, either from the scarcity of bodies, or from the prejudices of the populace.

Taking this circumstance into consideration, together with the obstacles which M. Gannal has encountered, the disgusts which he has had to surmount, in order to complete the experiments which he has made, your commission has the honour to propose to you to award to him, in anticipation, an encouragement of three thousand francs, (six hundred dollars.)

*Report of a Commission appointed by the Academy of Medicine, and composed of MM. Sanson, Roux, Dizè, Guèneau de Mussy, Breschet, reporter, to examine a process for the preservation of dead bodies, discovered and proposed by* M. J. N. GANNAL, *chemist.*

MESSIEURS,—If anatomy is the basis of all sound medical study, if almost all those who have most contributed to the progress of medicine and surgery have been skilful anatomists, it is rendering a great service to those same sciences and to humanity, to discover a method of facilitating the study of anatomy, and obviating its insalubrity. Well, gen-

tlemen, it is a discovery of this kind that M. Gannal presumes he has made.

By a letter dated on the 10th of March, 1835, addressed to the Academy of Medicine, by M. the Minister of Commerce, this learned body is charged to make known to superior authority its opinion of the real merit of the process of M. Gannal, for the preservation of dead bodies.

In consequence, the Academy has appointed a commission composed of MM. Sanson, Roux, Dizé, Guèneau de Mussy, and Breschet; it is in the name of this commission that I now present myself to make known to you the result of our labours.

Already two commissions from the Academy of Sciences have been occupied in the examination of this discovery of M. Gannal; the one, considering the process as useful to the study of the sciences which concerns the composition of organized beings; the other, considering it as a means of rendering less insalubrious an art or a profession, a prize having been founded for this purpose by M. de Monthyon, whose name will remain eternally dear to science and to philanthropy.

The reasons which have hindered the ancients from carrying to any great length a knowledge of the structure of man and animals, was not only the idea of filthiness attached to the sight and dissection of dead bodies, or the difficulty of procuring the means of dissection; but rather the almost absolute impossibility of preserving dead bodies in part or entire, which has retarded the progress of anatomy. Aristotle, to whom Philip of Macedon had given every facility for the dissection of animals,

and who must have made collections, does not say, in any of his known works, how he preserved the animals which he did not immediately examine, and Galien, in his anatomical administrations, says very few words of the means of preservation in liquors.

Cuvier, in giving the history of the progress of the natural sciences, teaches us that one of the circumstances which has the most contributed to the advancement of these sciences was the discovery of alcohol.

We are, however, astonished at the novelty of our means for the preservation of animals, for zoological and anatomical collections, when we reflect that during the time of Réaumur the art of preserving animal bodies with their natural forms and colours, was not known. Thus, in the cabinet of this celebrated naturalist, are seen birds skinned and suspended by the beak with a thread.

The taxidermic processes have almost all originated among us, for the formation of zoological collections; but we still are in want of less expensive methods, of easy transport, and in small space in order to preserve animals destined to serve for the researches of comparative anatomy, or for the study of the anatomy of man.

Peron, in the relation of his voyage to Terra Australis, in the commencement of the present century, laments the embarrassment of zoologists in long voyages, in preserving animals, without altering any of their zoological characters, and in a manner that they may serve finally for anatomical researches. He says, that it would be rendering great service

to natural history and zoology, if the following problem could be resolved:

"Any species of animal being given, to preserve it the most certainly, the most perfectly, and with the smallest quanity of an alcoholic liquid of the least possible strength."

Alcohol is very costly in this country, where considerable duties are exacted, nor is it suitable for preserving bodies, except of small volume. During voyages, this liquor is difficult of export, evaporates rapidly, particularly in equatorial regions, and often bursting the vessels which contain it; it alters or dissolves the resins or resinous mastic which is used to seal the jars or other vessels which contain the animals.

If an acid be added to alcohol, the bones are acted upon, and softened; colours are destroyed; the scalpels and other dissecting instruments are promptly oxidised, when it is desirable to dissect animals preserved in these liquors.

The same inconveniences exist if alcohol holds arsenic in solution, or corrosive sublimate, and many other metallic salts.

The essence of turpentine can only serve for small pieces; it is not easily transported, alters several of the tissues, becomes thick and clouded.

The oils are suitable only for the preservation of some fishes; their acquisition is expensive, and it is difficult to obtain them everywhere.

The syrups which have been proposed for the preservation of some animal parts, such as the brain, spinal marrow, &c., are too dear to be useful to any great extent; besides, they do no penetrate the

tissues profoundly, preserve only the external surfaces, deposit crystals or a viscous matter which changes the colour; and, finally, they run readily into fermentation, especially in hot climates.

Creosote, advised of late, for the preservation of the nerves and brain, is too costly, but, as we have not made use of it, we cannot describe its mode of action upon the tissues.

Sea-salt, employed alone and in solution, has a mode of action for a long time known, and its inefficiency cannot be disputed; we do not speak however, of saltings, because this method cannot answer for the preservation of bodies for dissection; or for preserving animals from putrefaction, that they may be subsequently dissected, or be placed in zoological collections.

In an English Medical Journal, for the year 1818, we find, that it is proposed to replace alcohol by *rock-salt*, for the preservation of anatomical and natural history subjects, which is known to be nothing more than muriate of soda, purer than that of commerce; this proposition is inadmissible.

The chlorides of the oxides of calcium, of sodium, of potassium, have been recommended for some pieces of pathological anatomy; but they are not applicable for the preservation of thick objects, and much less entire subjects.

Wine to which has been added a nitrous solution of mercury, has been employed by some navigators, for the preservation of small zoological collections; its use cannot be employed extensively. Acids, more or less diluted, alter the tissues, and attack the dissecting instruments.

Aqueous or alcholic solutions of the salts of mercury, arsenical solutions, &c., are dangerous, by their emanations, for the anatomist who constantly handles the objects impregnated with these metallic salts; and further they harden the tissues, contract them, destroy their colours, and attack anatomical instruments.

We may repeat of the pyroligneous and acetic acids, what we have already advanced of the other acids. Nevertheless, it was proposed about fifteen years ago, to use the pyroligneous acid, as excelling in its properties for preserving animals, and anatomical subjects.

All acids, not excepting vinegar, attack the colour of organic tissues, corrode them, and deprive the bones of their earthy salts, rendering them flexible and transparent, and cover the soft parts with a layer of gluey matter which conceals the fibres and the structure of the parts. It is known that alum and nitre are employed separately in aqueous solution, to preserve anatomical preparations, during the time of their fabrication. It is known that anatomists employ nitre, or simply saltpetre of commerce, not only to preserve the fleshy tissues,* but to give a lively red colour to the flesh.

We have thus, gentlemen, in a cursory manner, exposed the ordinary methods proposed or employed for the preservation of animal matters.

In order to respond to the Academy upon the merits of the discovery of M. Gannal, we will say that his process consists of an aqueous solution of

* Nitre possesses no preservative properties.—*Tr.*

three salts, already employed separately in the anatomical laboratory, *nitre, common salt, and alum.*

We have caused to be repeated under our inspection the experiments of M. Gannal. In the course of last March, two bodies were placed in a bathing tub six feet six inches long, sixteen inches wide, and twenty inches high. A liquor was poured upon these bodies, composed of acid sulphate of alumine, and of potash, of the chloride of sodium of each two parts, and one part of nitrate of potash.

The water which contains these salts in solution was in sufficient quantity to cause the liquor to stand at fifteen degrees of the areometer; that is to say, and according to the indication of M. Gannal, that the liquid should mark from seven to eight degrees during winter, and from twelve to fifteen during summer.

The tub was placed in one of the pavilions of the Practical School; and in the same room there were a great number of tables covered with dead bodies for the study of practical anatomy. At the end of two months, the two bodies were withdrawn from the bath, and dissected; no change had taken place in their exterior aspect; the tissues and internal organs were ascertained to be well preserved, and capable of serving for anatomical demonstrations.

Other subjects have been examined by the commission of the Academy of Sciences; they had remained in the same liquor since the 2d of December, 1834, and were still sound at the end of April, 1835.

We thought it our duty to exact of M. Gannal some other experiments; thus, we desired to see in-

jections with this preservative liquor, of the arterial system; we caused another subject to be injected with ordinary fatty matter; and at a later period we had injected into the vessels of the subject which had received the preservative liquor, a matter composed of suet, and of resin, in equal parts, and coloured with cinabar, (sulphate of mercury.) This last injection was successful. The first injection of saline liquid exacted eight quarts of the liquid, which was introduced through the left ventricle of the heart.

The subject examined at the end of two months, was well preserved, did not exhale any fetid odour, and might serve for the common dissection of students.

The commission were desirous to know whether a body would rapidly putrefy, if it were withdrawn from the tub and left upon the table of the amphitheatre, exposed to the air, and to the influence of the putred emanations from the other bodies. A subject was accordingly withdrawn from the preservative saline liquor, and remained fifteen days exposed to the air; no sensible putrefaction took place during this time; this was during the last fifteen days of April. The muscles of the corpse were seen to dry, and, so to speak, to mummify, whilst the tissues which had not come in contact with the saline liquid, or which had not been uncovered and exposed to the air, remained still in a state which permitted an anatomical analysis.

We ought to remark, that the tissues which are bathed by the liquid lose their natural colours; but the more deeply disposed organs did not experience

the same change; there was no emphysema in the cellular tissue, although we thought we remarked that there was less resistance in the fibres of the organs, than in a subject dead for twenty-four or forty-eight hours.

We may remark, that under no circumstances were long and deep scarifications made on the trunk or members, in order to allow the liquid to penetrate the thickness of the tissues. The cranium itself was not opened, nor was there any application of the trephine, in order to permit a more ready entrance of the liquor to the meninges, or to the brain itself. Nevertheless, after more than two months immersion in the liquor, the brain, extracted from the cranium, if it could no longer serve for new researches on its structure, might have been employed for demonstrations.

But, for how much longer time could this preservation be continued? What temperature is it capable of resisting? And what expense does it require? In fine, can the discovery be extensively applied? That is to say, is it possible, by this process, to preserve a great number of subjects during summer, to deliver them later to the students during the season of dissection? And if these subjects, thus preserved, exhale no odour, become in no manner a cause of insalubrity, or of danger to the students, for the anatomists themselves, or for the persons who inhabit the houses adjoining the anatomical amphitheatre, might not the dissections be indefinitely prolonged, in place of permitting them only during the rigors of winter?

In fine, has this saline liquor of M. Gannal pre-

servative properties sufficiently pronounced to be employed during long voyages, and in hot climates, for the purpose of bringing home numerous animals of large size, to serve for the study of comparative anatomy?

The small volume which saline substances occupy, and the sea water, which might serve to make the solution of the salts in any quantity as soon as needed, would be circumstances favourable to the use of this process.

In order to answer all these questions, it would be requisite to multiply the experiments, to extend them during a much longer period, and upon a very great number of subjects.

These experiments, directed in this spirit, would exact expenses which we thought ought not to be imposed upon the author of the process for the preservation of dead bodies, who has already been subjected to a multiplicity of demands, for the reimbursement of which we propose an indemnity from the Academy, without prejudice to the recompense which M. Gannal may have a right to claim, when the experiments shall have received that extension which we wish to be able to give them.

However this may be, we thought, in this provisionary report, that we ought to call the attention of the Academy, and of superior authority, to the process of preservation discovered by M. Gannal, and we manifest the desire that a sum be awarded to him as an indemnification for expenses already accrued, and in order to facilitate the means of continuing his experiments on a large scale.

We shall add that this process of preservation

may be very advantageously applied to various cases of legal medicine.

*Paris*, 16*th June*, 1835.

Signed, MM. GUENEAU DE MUSSY,
DIZÉ,
ROUX,
SANSON,
BRESCHET, Reporter.

*Certified.*—The perpetual Secretary of the Academy of Medicine.

Signed, PARISET.

The first report of MM. the members of the commission named by the Academy of Medicine was only provisionary; new facts were discovered to enlighten the conscience of the judges; these facts were presented, and the following report read to the Academy by M. Dizè.

*Definitive report of the commission named by the Academy of Medicine, to examine the process of preserving dead bodies, presented by* M. GANNAL.

GENTLEMEN,—The Academy had formed a commission composed of MM. Sanson, Guêneau de Mussy, Breschet, Roux, and Dizè, to make known the results of a process presented by M. Gannal, having for its object the preservation of dead bodies destined for dissection.

Our honourable colleague, M. Breschet, presented, in a provisionary report, the experiments which had been made, and the success obtained by M. Gannal.

But the commission having expressed a desire to

give more development to trials which, after the important results already obtained, deserved to fix the attention of the Academy, it proposed to him to multiply, to vary the experiments, to extend them a longer time upon a greater number of subjects.

But trials directed in this spirit, exact expenses; the commission did not think it just to impose them upon the author of the process, who had already multiplied expenses; in consequence it proposed to the Academy to demand an indemnity of government for expenses already made, and for the continuance of experiments, without any prejudice to the recompense that M. Gannal would have a right to claim.

The Academy seconded the wishes of the commission; it obtained from the minister of public instruction the sum necessary for covering all expenses made, and for those to be made in the continuance of the experiments.

.M Gannal made a series of preliminary experiments, which served him as so many starting points on the road to the discovery of the means of preserving animal matters; these labours subsequently conducted to the research of an antiseptic sufficiently powerful, which unites to the property of preserving bodies, that of not altering the organic tissues, and not too much weakening their natural colours, so important to anatomical demonstrations.

We shall cite the most important experiments, so that you may be able to appreciate the process which is proposed.

In the first place, acids in general modify the consistence of animal matters; they produce disorgani-

zation in proportion to their concentration; some diluted acids, for example, nitric acid at five degrees, may serve when it is necessary to study the nervous system, but then the bones lose their saline particles and are reduced to their organic frame; the muscles are discolored and faded, as well as the viscera; the nerves alone remain of a very remarkable mother-of-pearl whiteness.

Arsenious acid preserves bodies very well, but a single subject would require a killogram! Although the medical journals having spoken of a process discovered by Dr. Tranchini, of Naples, the commission judged it expedient to invite M. Gannal to repeat this experiment; a subject was injected with a killogram of arsenious acid and ten quarts of water; this subject examined by your commission, presented all the characters of a good preservation; but, on one hand, this process has been for a long time known, and on the other hand, the employment of it presents so many dangers, that in case of its success your commission would feel themselves obliged to proscribe it; effectually, when twenty subjects were under dissection, there would be twenty killograms of this poisonous substance at the disposition of the public.

Concentrated acetic acid preserves meats, but dries them. This same acid diluted retards putrefaction, but softens the bones, as well as the muscles, which are discolored by its action.

The alkaline salts only preserve meats when they are used dry, or in a very concentrated solution; it is necessary in this case that the salts preserve an affinity for the water of composition, so

that it may be said that these salts preserve meats because they dry them; thus, on this principle, salts more soluble in warm, than in cold water, may, injected as a warm concentrated solution, be considered as a means of preservation; this applies particularly to the nitrate of potash.

Creosote, a newly discovered vegetable substance has been recommended as a preservative of flesh; this fact demanded verification: a corpse which had been injected on the 18th of October, with one hundred scruples of creosote and seven quarts of water, was decomposed on the 30th of the same month.* But, in order to respond to the objection which was made, that the body should have been immersed in a bath saturated with creosote, it is sufficient to say that this bath would have cost forty dollars; besides the necessity of combatting the odour of the creosote, which may prove an obstacle to anatomical labours.

A solution of alum at eight degrees has succeeded better; but the flesh becomes hardened, faded, and friable.

The mixture of alum, (acid sulphate of alumine, and potash,) two parts, the chloride of sodium two parts, and of nitrate of potash one part, dissolved in water, employed as a bath, has afforded the first good results.

The acid phosphate of lime is the first substance

* To have given the creosote a fair trial it should have been injected undiluted with water; no one who has tried this curious product will deny that it possesses the most powerful antiseptic properties. I have used it formerly very successfully in my dissecting rooms for purifying subjects dead of mortification, foul ulcerations, or tainted by decomposition, especially the viscera. A small quantity of the creosote passed over the surface of these with a feather, immediately removes the fetid odours.

*Tr.*

which has been employed in injection for subjects; this salt did not oppose the movement of putrefaction.

The kidnies, injected with this salt, and immersed in the milk of lime, became hardened at the surface and putrefied in the interior.

After this first part of the experiments of M. Gannal, it results that the aluminous salts are those alone which succeed well in preserving animal matters, and which may be used advantageously.

Alum, employed alone, preserves well, but for a short time; this salt, slightly soluble in cold water, (fifteen degrees,) will not suffice as an injection for the preservation of a body; it is indispensable to immerse the body in a bath of the same salt.

The mixture of alum, salt, and nitre, as indicated in the provisionary report, has not the same inconvenience; a subject injected with this liquid, at ten or twelve degrees of density, may be preserved for more than a month; but it is indispensable to immerse it, at least from time to time, when it is desirable to prolong its preservation; that is to say, for the entire winter; but at a temperature above fifteen degrees, it is necessary to inject the liquid at a density of twenty-five or thirty degrees, and, in order to obtain it, it requires to be heated at least to forty degrees.

Several bodies injected with this liquid at ten degrees, on the 2d of December, 1834, were well preserved until the end of April; other subjects, injected on the 7th of August, but with the liquid at twenty-five degrees of density, and at ten degrees of the thermometer, were still, on the 10th of December,

in good condition, whilst those that were injected with a liquor of inferior density, did not resist a temperature of twenty or twenty-five degrees, although they were immersed in a bath denoting fifteen degrees. The bath of salted liquid has, independently of the inconvenience of expense for the necessary salts and the embarrassment of the tubes, which require frequent renewal, the objection of hardening the skin, considerably.

On these motives new efforts have been made, which have conducted to the following results: to demonstrate that all the salts with a soluble aluminous base, are decomposed; that those which are very soluble offer all the advantages of alum employed in very concentrated solution, and have not the same inconveniences.

For example, a solution of acetate of alumine at twenty degrees, injected the 16th of August, 1835, perfectly preserved a subject abandoned to the table without any other preparation; only, at the end of a month it was remarked that desiccation had commenced; when a part of it was covered with a layer of varnish, which preserved it from futher evaporation. At the present day, 25th January, 1836, the varnished part may be dissected as easily as a fresh subject, whilst the other part offers resistance to dissection.

During the first days of September, another subject was injected with acetate of alumine at fifteen degrees; although this was the corpse of a woman who had died from abortion, it was very well preserved.

On the 12th of December, a subject was injected

with the chloride of alumine at twenty degrees; this injection did not succeed well, and only three quarts could be introduced. Nevertheless, the body was perfectly well preserved. This want of success in introducing the liquid led to the following observation; that the chloride of aluminium at twenty degrees acts so powerfully on the arterial tubes and obliterates them to such a degree, that it prevents the passage of the liquid; but in order to remedy this inconvenience, it suffices to inject a first quart of the liquid at ten degrees, and the rest at twenty degrees. The chloride of aluminium has all the advantages of the acetate of alumine, and has further that of preserving the muscles of a bright red.

A mixture of acetate of alumine at ten degrees, and the chloride of the same base at twenty degrees, forms a good preservative injection. The use of one of these salts, or the mixture that has just been indicated, offers the advantage of preserving bodies, without its being necessary to subject them to any other preparation.

The density of the solutions of the acetate and chloride of aluminium must be graduated by the state of the atmosphere. When it is required to prolong indefinitely the preservation of the subject, it is essential to employ it at twenty degrees; it is equally necessary, in this case, to cover the subject with a layer of varnish, the sole object of which is to prevent the too prompt desiccation, which would prove an obstacle to dissection,

The first injections were made through the aorta. Subsequently, in order to avoid the laceration of the

pectoral parts, the subject was injected through the carotid artery, which always succeeded very well when the liquid was forced both upward and downward.

After the saline injection, at the end of forty-eight hours, coloured grease may be injected; even after two months the same operation may be performed with the same success.

From the series of experiments which we have just exposed, it results:

1. That a solution of alum, of salt, and of nitrate of potash, injected at ten degrees, answers for preserving bodies at a temperature below ten degrees of the thermometer; that, for a more elevated temperature, it is necessary to carry the density to twenty-five or thirty degrees, and immerse the subject in a liquid of ten or twelve degrees.

2. That it is preferable to employ the acetate of alumine, because it preserves better; as the skin experiences no alteration, and as the central organs remain *natural*, excepting the colour of the muscles which become bleached.

3. That the chloride of aluminium offers the same advantages.

4. That, in order to preserve parts of bodies which have not been injected, it is necessary to immerse them in a mixture of water, and of the acetate or chloride, marking five or six degrees.

But this part of the operation is transferred to the experiments which are to be undertaken on the preservation of objects of pathological anatomy.

Gentlemen, such are the series of experiments

made by M. Gannal, since the first provisionary report was presented to you.

The commission has attentively followed the new experiments; the results obtained, demonstrate that by M. Gannal's process bodies for dissection may be preserved, and the preservation prolonged beyond the term exacted by the most minute investigations.

As we have already stated, the soluble salts with an aluminous base, offer this preservative method without any danger in their use, and they can also be procured at a low price.

Their antiseptic properties are founded on their chemical action, which modifies animal substances either by depriving them of their water of composition, which determines their putrefaction, or in opposing themselves to its immediate action.

It is, then, only an act of justice rendered to M. Gannal, in considering his labour as an important service rendered to science and to humanity, and which may prove of great utility in anatomical explorations, and in legal medicine.

Consequently, your commission has the honour to propose to you the transmission of the present report—

1. To the Minister of Public Instruction, as an object of improvement in anatomical researches, and to reclaim the continuation of his good offices, in affording extension to the experiments for preserving objects of pathological anatomy.

2. To the Minister of Commerce and of Public Works, as an object of public salubrity. On the proposition of a member of the Academy, it was

unanimously decided to send the present report to the committee of publication.

Signed, MM. GUENEAU DE MUSSY,
SANSON,
BRESCHET,
ROUX,
DIZE, Reporter.

*Certified.*—The perpetual Secretary of the Academy of Medicine.

Signed, PARISET.

*Reflections.*—The mixture of the acid sulphate of alumine and potash, of the nitrate of potash, and the chloride of sodium, furnished me, at first, with some favourable results. But when new experiments were attempted at a temperature above 10° of centigrade, this liquid, which I only employed as a bath, did not answer my expectations. I then tried to inject bodies with concentrated solution, which were afterwards consigned to a bath of the same nature. The preservation was thus rendered more durable; but still it did not balance the influence of an atmosphere very warm and very humid, prolonged for any length of time.

I observed that after twenty-four hours of immersion of the bodies in the bath, all the alumine was absorbed: this fact, well established, was a gleam of light to me.

Since the preservation is produced by the combination of geline with alumine, and as the alumine furnished by the acid sulphate does not inherit enough of the preservative element, let us have re-

course to the salts of alum, richer in alumine, and more soluble in water.

The following are the data on which I rely:

*To find a salt of alum capable of effectually preserving bodies, and which, by the moderation of its price, may be extensively employed in amphitheatres.* I abandoned my trials with the nitrate of alumine, this being excluded by its *high price.* The chloride of alumine, with which I had experimented, is liable to equal objections: 1. Because, owing to its excessive affinity for water, it instantaneously dries the internal membrane of the artery, and obliterates the canal, rendering it impossible to finish the injection. 2. Besides, admitting the injection to have been completed by the introduction, in the first place, of a little oil of turpentine, the hydrochloric acid contained in the flesh injures the instruments, and impedes dissection. Further, the chloride of aluminium, like all the soluble chlorides, is a bad agent in dissections, being hygrometric.

The acetate of alumine is an excellent preservative of animal matters, as will be seen by referring to the observation cited at the end of the last chapter; but it is costly, and on this account cannot be employed in amphitheatres.

It was necessary, then, to search for a more economical method; this I have found in the *simple sulphate* of alumine. This salt, but indifferently known, no one having thought of it before me, is of a simple preparation and moderate price.

*A killogram of this salt, costing about twenty cents, dissolved in two quarts of water, is sufficient*

*in winter to preserve a body fresh, by injection, for three months.*

In order to preserve a body for a month or six weeks, it is not even necessary to inject the blood-vessels—*a glyster of one quart, and the same quantity injected into the œsophagus, suffices for this limited preservation.* This process is adopted at Clamart for all the dead bodies destined for dissection. The preservative power of this salt will be easily understood, if its analysis be compared with that of the double sulphate given above.

One hundred parts of *simple sulphate of alumine*, are composed of *alumine* 30, *of sulphuric acid* 70. This salt properly prepared, exempt from iron, commonly contains from thirty-six to forty for 0|0 of water.

The following is a table of the different densities of this salt, according to the quantity of water in which it is dissolved.

A killogram dissolved in five hundred scruples of water gives a quart of liquid which marks 32° on the areometer of Baumè.

This same quantity in a quart of water

| | |
|---|---|
| Marks, | 20° |
| In two quarts, | 17' |
| In four quarts, | 8° |
| In five quarts, | 6° |

This table is important, as it gives the composition of the different liquids of which we shall see the application.

The liquid of injection, of which we have indicated the preparation and the quantity, is sufficient

during winter, and moderate temperatures; but when it passes 20° it ought to be more abundant, or the solution more concentrated.

When it is intended to preserve the body for a longer period, it is necessary to neutralize the sulphuric acid, which is taken up by the addition of acetate of lead. Two hundred and fifty scruples of this salt for one killogram of the dry sulphate produces the desired effect. If the preservation is to be indefinitely prolonged, the use of the acetate of lead will have a tendency at length to blacken the epidermis. Indeed, as it is impossible to cause all the lead to disappear, the small quantity of this salt remaining in the liquid will be then decomposed by the hydro-sulphuric acid disengaged by the corpse, or rather by the sulphur which it contains, and the salt of lead is changed into sulphuret, a black insoluble powder, giving to the body all the exterior aspect of the negro.

I preserved in my cabinet an infant treated after this method; its skin, after the lapse of a year, became black, not of that colour assumed by animal matters in drying, but of the finest negro colour that could be conceived.

I finish with these details; for the facts of prolonged preservation of which we have just spoken are derived from the wants of the anatomists; and, previous to proceeding to other considerations, it is best to exhaust all that we have to make known concerning my processes of preservation applied in amphitheatres to subjects intended to be dissected. The preservation of these subjects, it is known,

would be prolonged without any advantage beyond two or three months at all seasons.

I shall therefore terminate all that is relative to this first portion of my labour, by the report of the committee of the members of the Institute. They have admitted the result of my labours to be of great utility, and that it merits the encouragement of the grand Monthyon prize, founded on the discovery of any means calculated to remedy the insalubrity of any art or profession.

The following is the report:

*Upon the preservation of the dead body, by* M. GANNAL.

The Academy is well aware, having recommended an encouragement to the author, that M. Gannal has made numerous experiments on the preservation of dead bodies, either with the view of making dissecting amphitheatres more healthful, or to obtain a method of embalming at the same time economical and certain.

As far as concerns embalming of dead bodies, it will be conceded that before advancing an opinion, it would be necessary to prolong the proofs for several years, which has not yet been accomplished for the process under consideration. Besides, as this investigation would be without the bounds of the duties of your commission on noxious arts, even when it shall have attained perfection, we were only disposed to examine it under the head of instruction. The judgment which we are about to give should then be considered as applying exclusively to processes concerning the amphitheatres of dissection.

In this latter case, the experiments being less tedious, could be varied and multiplied sufficiently to demonstrate that we actually possess a process capable of preserving dead bodies, during the longest period that the most minute dissection could exact.

This process is of an easy and economical execution; it consists in the employment of matters which have nothing poisonous in them. In fine, after many trials, the author has fixed upon the following method: he injects an aluminous salt dissolved in water, by one of the carotids; a few quarts of the liquid is sufficient, and the body abandoned to the open air is preserved for a long time from putrefaction; sometimes it even ends in becoming dry or mummified.

The author made use of the acetate of alumine, prepared by the acetate of lead and the sulphate of alumine and potash. This acetate of alumine at 18° of the areometer of Baumé, and in the quantity of five or six quarts, is sufficient to preserve a body for five or six months.

He has also used the simple sulphate of alumine in order to procure the acetate of this base. With one killogram of the simple sulphate of alumine in mass, two hundred and ten grains of acetate of lead, and two quarts of water, may be obtained, the necessary quantity of the mixture to preserve a body for two months.

By the employment of these processes, the preservation of bodies without odour may be calculated upon, for twenty days, a month, six weeks, more or less, according to the circumstances of temperature, state of the body, and quantity of the liquor actually injected into the vessels.

Your commissioners have assured themselves of this by the examination of bodies prepared by M. Gannal, but not wishing to report on their own judgment, and in order to obtain a full conviction of the practical utility of the process, it determined to consult those persons who were continually occupied in dissection. Their opinion was unanimous.

Among the experiments or applications of which the process of M. Gannal, has been the object, we shall place in the first rank the series of facts observed by our honourable associate M. Serres. The following are the details which he has transmitted to use on this subject.

"In the month of June, 1836, in the amphitheatre of the hospital, the body of a man twenty-two years of age was injected. Abandoned to the open air, in a cabinet exposed to the south, and upon a wooden table, it was preserved until the month of September, and it ended in becoming mummified.

"In the month of July, eight bodies were injected for dissection, each during fifteen days.

"During the months of August and September, sixty subjects were injected; these were preserved for twenty days.

"From these experiments, adds M. Serres, it results that the liquid furnished by M. Gannal preserves bodies to a certain extent:

"1. Permitting their dissection during summer, a thing which has not been accomplished heretofore in the anatomical school of the hospitals. 2. Permitting to give to the instruction of operative medicine a development which, up to the present period, it had not enjoyed; for, during the months of Au-

gust and September, we were enabled to preserve, as in the middle of winter, thirty bodies at a time on the tables, enabling us to repeat to seventy pupils all the operations, in following a regular course, previously impossible."

To this series of observations, already so decisive, we shall add the intelligence furnished us by different anatomists well known to science.

Thus M. Dubreuil, the honourable dean of the faculty of Medicine of Montpelier, hastened, in the interest of anatomical studies, to make the necessary trials to assure himself of the efficacy of the process in question. During the spring of last year, the first body on which he operated was preserved for forty-one days, and the experiment was terminated without any thing announcing putrefaction. On a second body the result was the same, although it was chosen under the most unfavourable conditions.

M. Bougery, who, it is known, is occupied in the publication of a great work on anatomy, declares that this process has very well succeeded in his hands, and that it has been very useful to him. In summer he injected two subjects which were preserved for three weeks; in winter, he injected a third, and this, although kept in a room heated to 15°, was preserved for seven weeks.

M. Azoux, who, at a distance from Paris, has formed an establishment for the manufacture of his artificial anatomical preparations, employs the process of M. Gannal, in order to place before the eyes of his workmen the preparations which they are to reproduce. This process has rendered him great service.

MM. Velpeau and Amussat, who have had occasion to put it to the proof, have been equally well satisfied with it.

Your commission was further enlightened by a report made to the Academy of Medicine, which includes circumstantial details of the successive trials through which M. Gannal had to pass before attaining the simple and easy method which he employs at present.

After the whole of the intelligence which it has collected, your commission feels itself authorized to say, that the process of M. Gannal, as it now exists, may render the greatest service to anatomical studies; that it divests them, in great part, of what is repulsive, and deprives them almost entirely, perhaps, of what is insalubrious.

We have just seen that M. Bougery, M. Amussat, and, in general, all who consign themselves to continued anatomical researches, follow this process, and have found benefit from it. It is desirable that it should have been adopted in some grand amphitheatre of anatomy, and that its use should have been subjected to the chances of an extensive practice. It appears that the additional expense which its application would occasion, has opposed its introduction, thus far, into such an establishment.

Nevertheless, it is incontestible, that the use of the injections of M. Gannal deprives subjects of all putrid odour, and it is to be hoped that it will diminish, if not altogether put an end to the serious accidents which happen too often to anatomists who are so unfortunate as to be wounded in dissecting.

This is yet only a presumption; extended experience can only determine the fact.

Your commission thinks, then, that it has reason to recommend the adoption of this process in the amphitheatres of dissection, notwithstanding it may occasion a slight increase of expense. How trifling, indeed, is this consideration, when it is proposed to render anatomical studies more easy, and more healthful; when it is calculated to render them more fruitful, since each subject could be made to serve a greater number of students, who, working without disgust or repugnance, would much better preserve the free exercise of their faculties!

All things considered, the expense, already inconsiderable, and which will become still less hereafter, is then equivalent to real economy, if, for example, the cost of an anatomical education to a student be calculated. By the aid of the new process, fewer subjects are necessary for the same number of students; or rather, with the same number of subjects, the education of a much greater number of students may be completed.

Your commission has been strongly impressed with these considerations; it has thought that the process under consideration was sufficiently proved; that it might, even now, be practised habitually in dissecting amphitheatres; and that this has not already been effected, is evidently due to administrative circumstances.

Consequently, it has the honour to propose to you to award to M. Gannal a prize of $1600.

The members of the commission agreed that it

was expedient to recommend my process to the dissecting amphitheatres: their wish is in part accomplished, since, by decision of the central administration of hospitals, the *subjects are henceforward to be subjected, in the capacious chambers of Clamart, to one of the injections, the compositions of which I have given.* This decision will not astonish those of our readers who are aware that M. Serres is charged with the direction of the anatomical arrangements at Clamart; this gentleman, whose works have elevated him to so distinguished a rank, has been long known for the zeal and noble disinterestedness with which he advances all useful discoveries.

2.—*Preservation of subjects of normal anatomy, of pathological anatomy, and of natural history.*

As it is my intention to publish hereafter a complete work on the preservation of pieces of pathological anatomy, and of objects of natural history, which, besides the details into which I might enter, would lead me beyond the proper limits of this work, I shall confine myself here to some results obtained during the last three years, and the composition of the liquids derived therefrom.

1. In 1833, I took the thigh and all the organs contained in the abdominal cavity of an infant at full term, and treated them after the manner to be hereafter indicated, and at the present moment, 8th December, 1837, I preserve the pieces in two jars. They display no sensible alteration, and are as fit for study as when first separated from the subject.

2. In 1835, Dr. Beniquet having to pursue some

investigations on the brain, he made use of my liquor in order to preserve entire heads, for which he had occasion. After his experiments were finished, he presented to me a head which remained, and which I preserve in my cabinet. It is impossible to detect the slightest trace of change in it.

3. I have preserved unaltered for three months, the head of a Bar, (a species of Silurus,) weighing several pounds; this head has served for dissection.

4. I have preserved leeches and other worms for several years, without perceiving that they had lost any of the characters necessary for the naturalist to know.

5. The same observation applies to the different organs of birds and mammalia: the heads of pheasants plunged, feathers and all, into the preservative liquor, after fifteen days of maceration, present the red colour around the eye of as lively a shade as at the moment of immersion.

I might multiply these examples, and produce several hundred trials equally conclusive, made during the course of my experiments; but as it could not result in any advantage to the reader, I forbear. Besides, the use that Captain Durville has made of my liquor during his scientific voyage, and the thousand proofs to which it is every day subjected on the part of men, whom the study of natural history induces to have recourse to it, will be the most faithful and sure confirmation.

In fine, I shall always be most happy to receive the observations, remarks, and criticisms of those, who, with an interest for science, may have occasion to point out to me any circumstances calculated

to modify the applications. Many, without doubt, may have escaped me, and as I desire, above all things, to bring my processes to the highest degree of perfection, I shall be thankful for any aid that may contribute to this end. The following is the composition of the liquids[1] which I employ for preserving the different pieces of normal anatomy, pathological anatomy, and natural history.

1. A solution of the simple sulphate of alumine, at six degrees; that is to say, the solution of a killogram of this salt in six quarts of water.

2. A solution of simple sulphate with water saturated with arsenious acid:—five hundred scruples of arsenic to forty quarts of water;—six quarts of this solution to one killogram of the simple sulphate.

3. Of the acetate of alumine at five degrees, saturated with arsenious acid.

*Usage.*—For fifteen days I cause the pieces to disgorge in the first liquid; at the end of this period they are withdrawn and placed in the bath of a second liquid, where they may remain for from three to five months; finally, they are withdrawn and placed in a third liquid. It is thus that I have preserved preparations for three or four years, which the public is welcome to come and see.

It would be useless to recur here to dried preparations, having given an example of them in the seventh chapter; nevertheless, as I then only indicated

[1] These liquids, which may be employed for the limited preservation of fish destined to dissection, will not answer for their indefinite preservation, but I shall have occasion, in my work on the preservation of pathological anatomy, to indicate another process.

the injection of acetate of alumine, without making any observation, one of the results which I have attained by the simple sulphate, reported now, will be a useful confirmation of the process which I have given before. Distinguished men have examined the viscera and vessels of a subject injected for six months, and we shall see how satisfactory was the state of the organs after so long a period.

M. Professor Dumas, treating of the acetate of alumine in the lectures which he gives in the Polytechnic School, was led to refer to the application which I had successfully made of this salt, for the preservation of bodies. He requested me to lend him some preparations to show to the students of the school. I lost no time in sending him several specimens; I added the first body which I had injected with the solution of the simple sulphate at thirty degrees; it was the corpse of a fœtus that had only lived fifteen days. Injected six months ago, and abandoned to the air of my laboratory, this body had lost about one-half of its water of composition; the feet, the hands, the ears, were dried;—the face was covered with *byssus*,[1] but no trace of decomposition evinced an approaching dissolution of the organs.

On the next lecture, Cazalis asked me in what state the vessels ought to be found in this stage of the preservation. The subject, I remarked, is at

[1] These productions on the surface of dried preparations, not covered with varnish, do not produce, it is true, putrid decomposition, but they change, and tend to destroy them. I have experienced all the inconvenience of this fact in embalming; after numerous trials I have discovered a method of preventing it.

your disposal, and you can satisfy yourself. He then opened the chest, placed the syphon in the aorta, and a fatty injection of about three hundred scruples was forced into the arterial system.

The injection having cooled, the subject was opened; the intestines were in a remarkable state of preservation, and the injection had penetrated them, as well as the brain, which was found in a healthy state. Finally, the brachial artery, followed in its divisions and subdivisions to the palm of the hand, was seen to be injected. Since this period, I often show this subject to persons who visit my laboratory; it is immersed in the preservative liquor, and I can submit it to the examination of anatomists, for whom facts only are important. Observations of this nature prove that I have given to anatomists the means of preservation which respond loudly to all the wants of the science; and it ought further to be remarked, that my experiments have been conducted under the most unfavourable circumstances. Indeed, for the trial of all the substances which I supposed possessed of preservative properties, I have chosen, as in the preceding case, fœtuses, as subjects the most disposed to fall into putrefaction, as in them animal matter is not completely formed, and they include a considerable quantity of water of composition, much geline, and very little muscular flesh. This method of proceeding has enabled me to dispense with numerous attempts, and to avoid deception. The aspect of fœtuses, and the intimate structure of their tissues vary little from each other; but the difference, very trifling for these subjects, is immense in men of advanced age; the temperament, and idiosyncrasy,

which display themselves later, establish a thousand degrees, a thousand shades in the tendency to decomposition, and the subject which cedes most rapidly to dissolving causes, is scarcely on a par with new-born infants. This opinion, which can be established by facts, if necessary, convinces me, independently of my experiments, that all means proper for the preservation of infants, may, *a priori*, be supposed an excellent process for the preservation of all animal bodies.

I possess in my cabinet a dozen of fœtuses, injected at different periods with the acetate of alumine, or the simple sulphate, some preserved in the liquid, others abandoned to the air: on these pieces may be perceived the different phases, the various transformations produced by time and chemical agents on animal matters. Some of these subjects, prepared for more than a year, are in as favourable a state for anatomical study as on the day of their death; others, submitted to the action of the air, have become dried, and offer the appearance of the mummy of the sands.

### 3.—*Embalming.*

I have presented a history of embalming as complete as the nature of the case would admit; as a historian, I have investigated those sources most worthy of credit; I have collected all the documents of interest, and have used them as occasion required; observations and criticisms have lent their aid, either to enlighten or correct information, and admitted opinions: I have, above all, endeavoured to confine

myself to scientific data. From the mummy of the sands to that obtained from the deuto-chloride of mercury, these two extreme points of my endeavours, this was the idea which prevailed, and directed the exposition of my subject. I shall not depart from this method in order to make known my work; I shall abstain from all conjecture on the duration of bodies embalmed by my process; here, too, I confine myself to facts, and to the deductions which are naturally derived from them.

I refer to the end of the sixth chapter for the advantages resulting from my processes compared with all others, and I resume the subject where I left it in the preceding chapter.

The acetate of alumine, and the simple sulphate, ought to be chosen in preference to all other dried substances for the preservation of bodies; these two salts can render to anatomists all desirable services; but the study of their action ought to be extended further for the purposes of the embalmer.

What happens, then, when a subject is injected with one of these two salts? They remain exposed to the thermometric and hygrometric variations of the air, and should undergo one of the following transformations; or rather, submitted to the action of a dry and free air, they rapidly dry; or preserved in a close and humid place, they become emaciated, blackened, and covered with mouldiness, without, however, experiencing putrid fermentation; they decompose like skin or tanned leather enclosed in a humid place, or beneath the earth. These transformations experienced by bodies thus prepared, were

an obstacle to the application of my process to embalming.

There remained for me, then, an ulterior series of observations in order to prevent these unfavourable results.

*It was necessary to discover a method of preserving bodies always fresh, with the appearance of sleep, in the state in which they exist immediately after death. It was necessary that the preservation should be indefinitely prolonged; that is to say, that the embalming be such a one that it would allow a dead body to be preserved in all its integrity, without mutilation, without incisions, and fit for dissection at will at all possible epochs.*

Have I fulfilled these conditions? Let the facts answer.

*First observation.*—In the month of February, 1836, at the request of Dr. Petigard, I embalmed the body of the son of M. Dupré, architect, living in Cerisarie street, No. 13.

This child, aged about twelve years, was interred in the cemetery of Père la Chaise. During the construction of the monument, which the father caused to be erected to him, some of his friends excited doubts as to the efficacy of my method of preservation. Wounded in his affections, M. Dupré conceived suspicions which he communicated to Dr. Petigard, expressing the desire for the exhumation of the body. He advised me of this, but numerous occupations prevented me giving it immediate attention; he attributed my delay to hesitation, to the fear I had of seeing my promises made to the rela-

tives contradicted, and, as he has since avowed, expressed himself without reserve on my account.

Finally, the opening of the coffin was made in the month of July, 1837; when the unfortunate father, feeling revive all his grief at the sight of his son, whom he found exactly in the state in which he was at the moment of inhumation, regretting, besides, his suspicions of me, embraced me with effusion, and gave me every proof of his lively gratitude.

"Your hesitation," he remarked, "made me fear that I had been deceived, under which persuasion I have undoubtedly prejudiced several persons against you, but I will repair the fault in telling the truth." Here is one fact which may appear of some value, and that which follows is none the less conclusive.

*Second observation.*—Dr. Oudet, surgeon dentist, died at Paris, Dauphine street, was embalmed sixth March, 1837, after my process; his body was deposited in a coffin of oak, without a lining of lead, and placed, thus enclosed, in a clayey, humid soil. Three months after, the exhumation was made, in presence of M. Prunier, commissary of police for the quarter of the observatory, and of Dr. Petit. The body was found in such a perfect state of preservation, that it astonished the numerous persons present at the exhumation; all admitting that the aspect of the defunct was exactly that of a man asleep: a "procès-verbal" was drawn up on the spot, to prove the state of the body. The following is a copy of it:

"I, the undersigned, Doctor of Medicine of the faculty of Paris, certify, that on the sixth of March,

1837, M. Gannal embalmed, by his process, the body of Oudet, senior, Doctor in Medicine, who lived No. 24 Dauphine street. This operation was performed in my presence, no other opening being necessary than that in the carotid artery, and was finished in less than half an hour.

"On the twenty-eighth of May following, the exhumation of the body was made in my presence, that of M. Prunier, commissary of police, the persons attached to the cemetery, and some spectators. The body, which had remained three months in the earth, and in a coffin not lined with lead, was in such a perfect state of preservation, that all present declared that it resembled a man asleep.

Signed, H. PETIT."

It is, perhaps, unnecessary to refer here to the embalming which I made at the request of Dr. Husson. I had to preserve the body of the nephew of General Guilleminot, who died at the hotel de Bade, Helder street. The mother requested that her son should be dressed in his usual manner, and placed on a bed of repose as if asleep. He remained fifteen days in this position before being enclosed in a coffin, to be transported to the family sepulchre. I abstain from mentioning many instances of exhumation made at my own request, because they need the authenticity of character necessary to facts, from which are to be drawn scientific results. Besides, it will always be easy, when any scientific body or the authorities desire to assure themselves of the efficacy of the means which I employ, to obtain an

exhumation and prove the state of the subjects thus prepared.

I preserve in my cabinet the body of an infant of ten years, embalmed for more than eight months; the countenance of this subject, which remains uncovered, has not experienced any alteration; his open eyes* give his physiognomy the expression of astonishment often observed on first awakening.

If such results can offer any consolation to families who lament a painful loss, I have received my reward.

* The eyes have been replaced by artificial ones.—*Tr.*

# APPENDIX.

We propose to make a few general observations on the process of M. Gannal, and add some remarks on anatomical preparations, in order to make the present work more complete.

The perusal of this volume must convince any one that we are indebted to M. Gannal for a real improvement in the progress of anatomical science. But, as is generally the case with authors who urge a research into any particular department of science with equal enthusiasm, M. Gannal has, perhaps, overrated the extent and importance of his discovery. The commissioners appointed by the Academy of Sciences, and the Royal Academy of Medicine, have satisfactorily demonstrated the great utility and novelty of M. G.'s process, in preserving bodies for dissection without materially altering the organic tissues, or offering any injury to the instruments of the dissector. And the museum of the author contains numerous specimens, to show that subjects injected by his process and dried, are capable of resisting destruction for ages; but we did not observe any specimens during our examination of them, which retained so close a resemblance to living nature, as his accounts would lead us to believe, with the exception of those which had been recently injected, and previous to the process of desiccation; a process which always results unless the object is enveloped by a preservative liquor, and thus adding considerably to the labour and expense. Whilst the process of desiccation produces such contraction and distortion in the subject, as to render the new method of embalming ever inapplicable as a general means of accurately preserving birds and quad-

rupeds as objects of zoological collections. But it might be made an economical and expeditious method of preparing objects of natural history during long voyages, as such objects could be subsequently moistened and subjected to dissection. But desiccation does not immediately follow preservation by this process; as was satisfactorily exemplified in the person of the late Archbishop Quelin, who died during our residence in Paris, and who was thus embalmed at his own dying request, and whose body retained its natural appearance after several weeks exposure to public view in the church of Notre Dame.

A more useful application of the process has also been made by the police of Paris, in preserving bodies for many weeks in the morgue, where suspicions of murder exacted an unusual retention of the body.

The specimens of pathological anatomy, preserved in the same liquid of injection, were not exempt from the usual inconvenience attached to similar preparations in a solution of muriate of soda and other salts, being equally liable to incrustations, requiring a change or renewal of the solution.

In the preservation of *birds* by this process it was found sufficient to inject the body by the trachea, subsequently suspending the animal by the feet in order to drain it of the superabundant fluid, and then giving it a fixed position by means of wires; such preparations retain their flexibility and natural appearance for some weeks, or until desiccation commences.

The powerful preservative properties of aluminous salts have been long known, and were not unfrequently resorted to by the ancients. Some remarkable instances of preservation by such a medium have accidentally occurred in our own country, among which the following may be here noticed. That distinguished officer of the American revolution, General Wayne, died thirty or forty years ago at Erie, Pennsylvania, and was buried in the vicinity of the lake; the body was not long since disinterred and removed by

his son, who was astonished to find it in so perfect a state of preservation—and on examination it was discovered to have been deposited in an argillaceous soil strongly impregnated with a solution of alum.

Another interesting instance occurred many years since in the State of Maine, where the body of a person, missing for several months, was discovered in a clay pit, into which it had fallen, face downwards, enveloped in moist clay; the features were recognisable, although the parts of the body exposed to the air had long decayed to a skeleton.

The interesting and important subject of embalming, and of preserving and preparing anatomical objects, though much improved of late, is by no means exhausted. It has long been our desire to turn our attention in a special manner to such researches, and to have instituted numerous experiments, but imperative duties, and unexpected events, have interfered with such views for the present—we are not without a hope, however, that some one of our countrymen, more fortunately situated, will push his discoveries in a direction which affords so admirable a field for distinction.

The investigator might even be so fortunate as to discover the lost secret of the Florentine Physician, *Segato*, for *petrifying* animal substances! The problem is by no means an unphilosophical one, nor yet a chemical anomaly—it is only perfectly to saturate, by injection or otherwise, animal substance with the silicate of potash, or liquor of flints,—(*Verre Soluble, of Fuchs,*) and subsequently to immerse it in a weak acid solution:—the "methodus operandi," remains to be discovered. (Consult *Dumas*, Traité de Chimie, Vol. 2. p. 577, for an interesting chapter on "Verre Soluble.")

Bodies of men, horses, &c., have been preserved for centuries in the bogs of Scotland and Ireland; it is to be presumed that these must have been immersed when the temperature was low, as we have always failed in attempting to preserve bodies in a saturated solution of gall nuts, dur-

ing warm weather but an injection of the vessels with the tincture of galls has proved more successful.

We have already demonstrated by experiment that Tranchini's arsenical solution is inadequate as a means of embalming, (vide *Note*, p. 211 of this volume.)

The mercurial corrosive sublimate, as a means of preserving from corruption, in addition to the palpable objections to its use designated by our author, exacts much time, labour, and expense, and not unfrequently fails altogether, whether applied to animal or vegetable substances.

The sulphate of copper, has more recently been proposed as a preservative of vegetable matter, especially as applicable to the blocks for paving streets; its properties as a preservative of animal matters have long been recognised. We have read of human bodies found in some parts of Germany, preserved entire for many years, by being deposited in a soil strongly impregnated with this salt.

About the close of the year 1839, we read in the Medical Gazette, an account of some experiments performed by Drs. Babington and Rees, with the view of preserving human bodies, for the purposes of dissection. After numerous unsuccessful trials with various antiseptic substances, they succeeded to their entire satisfaction by simply injecting the arteries of an adult with one gallon of pyroxilic spirits; of which substance, (which must not be confounded with pyroligneous acid, or pyro-acetic spirits,) a full account may be found in the "Annals of Philosophy," N. S. VIII, 69. According to the authors, the advantage of employing Pyroxilic Spirits are—1. Its extreme fluidity. 2. Its freedom from colour. 3. Its cheapness, being only one half the price of alcohol. 4. Its innoccuous nature, and its freedom from any corrosive action on dissecting instruments.

In the London Medical Gazette, for December, 1839, there is a memoir of Dr. Thomas Marshall, on the same subject, who thinks he has discovered a much cheaper and more effectual method—which consists in puncturing the surface of the body very generally with needles or scissors,

&c., and brushing over the body with acetic acid, specific gravity 1.048, which must be brushed into it slowly and repeatedly, the same acid slightly diluted with water, to be introduced into the great cavities. This process, the author asserts, has not only preserved bodies perfectly sweet for months; but is capable of restoring the natural colour to parts already gangrenous.

To use the author's own words, "two days' application in this way, will beautify any subject." The face of a corpse thus punctured, and supplied with compresses moistened with this acid, would be preserved, or even restored to its natural appearance, when discoloured by incipient putrefaction. John Hunter and other contemporaneous surgeons were in the habit of using diluted nitric acid for this purpose, but we have frequently seen this application fail, in our climate, when puncturation was omitted.

Most beautiful specimens of *natural skeletons* may be obtained by employing *tadpoles;* the animal must be divested of its skin, and the bones roughly cleaned of their flesh, and then suspended in water, exposed to the depredations of the tadpoles, who delicately remove, atom by atom, the softened flesh still adhering to the skeleton, by means of their suction mouths, in the course of a few hours, during warm weather; when the preparation is to be placed in position and dried. The aid of the ant has also been successfully invoked for a similar purpose. A small quadruped prepared as above, is placed in a box, and deposited in the vicinity of an ant's nest; these industrious operatives rapidly remove the flesh from the bones.

As approaching the nearest to natural objects, we can securely recommend the accurate anatomical preparations in *Carton*, of Dr. Azoux, of Paris: the annual course of popular anatomy which he delivers, and which we have had the satisfaction of attending, are admirably and accurately illustrated by this means.

These preparations consist not only of every part of the human body, but of entire subjects, both male and female, in-

cluding the gravid uterus. The only objection that can be urged against them, is the high price, say six hundred dollars for the entire adult subject.

Equally valuable is the more recent invention of another Parisian artist, of a material which he denominates "Carton pierreuse," which appears to be a composition of "papier maché" and ground plaster of Paris, with which he executes anatomical models of great beauty and accuracy, including innumerable pieces of morbid anatomy, coloured to nature. Either of the above preparations are vastly superior to those in wax; they are more durable and more natural.

The study of minute anatomy has been yet further essentially aided, by the representations of the nerves, arteries, and veins of the head and face, by means of wires enveloped in wax, coloured after nature; these constitute very accurate and handsome preparations, and are the ornament of anatomical museums, as manufactured by M. Guy, adjoining the School of Medicine in Paris.

Preparations of the nerves and blood vessels of the entire subject, distinct from the body, are made in a similar manner; fine specimens of which are contained in the Museum of Comparative Anatomy in the Garden of Plants. The endless variety and perfection of the preparations, models, &c., as a means of prosecuting anatomical studies at the present time, are strongly contrasted with those at the command of the student in the days of Harvey; when the vessels and nerves were imperfectly displayed with great labour and expense by the tedious process of dissecting them from the body and drying them on a board. Valuable specimens of these kinds of preparations from the cabinet of Harvey, are still scrupulously preserved in the cabinet of the Royal College of Physicians of London.

It will only be necessary to add here, a few formulæ for the various kinds of injections used in the preparations of the blood vessels by the American and English anatomists, which will be observed to differ considerably from those used on the Continent, by reference to chapter seventh of

this volume, where will also be found formulæ for the composition of varnishes: as regards the various methods of manipulation requisite for the preparation of each particular part of the body, these will be best obtained by the student's personal application to the anatomical instructor or assistant connected with medical schools and teachers of practical anatomy.

We have found, by experience, that the great secret of success in anatomical injections, consists in first heating the part, or subject, thoroughly in hot water, the temperature of which, for an entire subject must be continued for ten or twelve hours, or until the deepest parts are equally heated; secondly, to take the precaution to reduce the colouring matters to an impalpable powder, and use the injection at as high a temperature as possible without injury to the tissues.

*Formulæ for coarse Injections.*

| | |
|---|---|
| *Red.*—Yellow bees-wax, | 16 ℥. |
| White resin, | 9 ℥. |
| Turpentine varnish, | 6 ℥. |
| Vermilion, or carmine, | 3 ℥. |
| *Yellow.*—The same materials, substituting for the red colouring matter, King's yellow, | 2½ ℥. |
| *Black.*—Substituting lamp-black, | 1 ℥. |
| *Green.*—Substituting crystallized verdigris, | 4½ ℥. |
| Best flake white, | 1½ ℥. |
| Gamboge, | 1 ℥. |
| *White.*—Substituting fine white bees-wax, and best flake white, | 5½ ℥. |
| *Pale blue.*—The same, substituting fine blue smalt, | 3½ ℥. |
| *Dark blue.*—Substituting blue verditer, | 10½ ℥. |

First liquify the wax, resin, and turpentine varnish, over a slow fire, in an earthen pot, then add the colouring matter, previously mixing it in another pot, with a very small quantity of the liquified composition, and stirring it well

with a wooden pestle, so that the colouring ingredients may be intimately and smoothly blended; then add, by degrees, the whole of the ingredients, and when they have acquired their due heat, by being placed again over the fire, the injection will be ready for immediate use. A quantity of the ingredients of these injections may be kept prepared without the colouring matters, which may be added in their proper proportions, *pro re nata*. The ingredients become brittle by frequent melting, and turpentine varnish must be occasionally added. The same rules apply to the mixture of the following

*Formulæ for fine Injections.*

| | |
|---|---|
| *Red.*—Brown spirit varnish, white spirit varnish, *a.a.* | 4 ʒ. |
| Turpentine varnish,* | 1 ʒ. |
| Vermilion, | 1 ʒ. |
| *Yellow.*—The same, substituting King's yellow, | 1¼ ʒ. |
| *White.*—Substituting best flake white, | 2 ʒ. |
| *Light blue.*—Substituting fine blue smalt, | 1½ ʒ. |
| Best flake white, | 1¼ ʒ. |
| *Dark blue.*—Substituting blue verditer, | 4 ʒ. |
| *Black.*—Lamp-black, | ½ ʒ. |

*Formulæ for Minute Injections.*

The size which constitutes the principal part of these formulæ, is made in the following manner:

Take the finest and most transparent glue, one pound, break it into pieces about the size of a nutmeg; put it into an earthen pot, and pour on it three pints of cold water, let it stand twenty-four hours, stirring occasionally with a stick; then set it over a slow fire for half an hour, or until the glue is perfectly dissolved; skim off the froth from the surface and strain it through flannel; then add the colouring ingredients.

* The varnishes go by measure.

| | | | | |
|---|---|---|---|---|
| *Red.*—Size, | one pint— | | Vermilion, | 3½ ʒ. |
| *Yellow.* | " | " | King's yellow, | 2½ ʒ. |
| *White.* | " | " | Best flake white, | 3½ ʒ. |
| *Blue.* | " | " | Fine blue smalt, | 6 ʒ. |
| *Green.* | " | " | Crystallized verdigris, | 2 ʒ. |
| | " | " | Best flake white, gamboge, *a.a.* | 8 ȝ. |
| *Black.* | " | " | Lamp-black, | 1 ʒ. |

### *Cold Injections.*

Whilst pursuing practical anatomy in the University of Pennsylvania, in the year 1814, under the direction of Professor Wistar, I became acquainted with a material for many years known in that institution under the denomination of "*Spalding's Cold Injection,*"* used for the purpose of filling the bloodvessels, without the preparatory measure of heating the subject or the injection ingredients—its use exacted great care on the part of the manipulator, and frequently failed; although, when successful, it surpassed all other coarse injections in minuteness. It was composed by grinding white lead and red lead, of each 4 ʒ, in a sufficient quantity of boiled linseed oil to form a thick paste, adding, just previously to injecting, turpentine varnish 8 ʒ.

Dr. Parsons gives the following formulæ for cold injections. (*Vide Parson's Anatomical Preparations,* p. 2.)

"*Cold coarse Injections.*—This kind consists of colouring matter ground in boiled linseed oil upon a painter's marble, and made of the consistence of white lead, ground in oil. After being finely levigated, a little lime water, in proportion of two table spoonsful to a pint, is to be incorporated by stirring. At the moment of filling the syringe with the injection, there should be added to it about one-third of its measure of Venice turpentine, which should be stirred quickly, and used immediately, as it very soon hardens.

*Dr. Spalding was a native of Massachusetts, and a student of the late Professor Rush, some thirty or forty years ago.

The use of the lime water is to harden the injection; but when white lead (which is almost always adulterated with carbonate of lime) is used, lime water is unnecessary.

"*Cold fine Injections.*—The same materials will answer, only adding to the Venice turpentine an equal quantity of spirits of turpentine. This is generally thrown in the vessel in small quantities at first, and followed by the above coarse injection.

"*Cold minute Injection.*—This may be the same as the warm minute injection; or it may consist of vermilion ground very fine in spirits of turpentine, adding a small portion of Venice turpentine, the whole being as fluid as milk, and when thrown in, should be followed by the cold coarse injection."

### *Swan's cold Injection.*

This consists of plaster of Paris, to which some colouring matter has been added, and water gradually poured on it until reduced to the consistence of cream—taking care to cleanse the syringe immediately after injecting. For making corroded preparations of the kidney, &c., the *fusible metal* may be thrown into the artery, after heating the organ (but not the artery) until it acquires the temperature of boiling water—to be afterwards treated as directed in this volume.

A simple injection, adequate to all useful purposes, where it is only intended to illustrate the bloodvessels, consists of tallow, melted and coloured. Or the following, which is in general use in the Parisian dissecting rooms: Lamp-black, ground in oil, adding the lime water and turpentine as above mentioned in the cold coarse injection.

It is difficult, at the present time, to ascertain to whom anatomy is justly indebted for the discovery and first introduction of arterial injections, &c. The first use of wax injections has been attributed to Swammerdam, in 1672, although it is probable that De Bils and Ruysch preceded him. The Sieur Disenclosses possessed a cabinet furnished

with over one hundred pieces, many consisting of injected vessels, a description of which was *published* in 1727, but the collection must have existed many years previously.

Corroded preparations have been attributed to Francis Nicolls, Professor of Anatomy, at Oxford, about the beginning of last century; size injections to Rouhaut, surgeon to the King of Sardinia; the fusible metal, to Homberg, of Paris, (this metal is composed of an equal proportion of tin, bismuth, and brass,) who used a pneumatic apparatus for forcing it into the vessels; the origin of Spalding's cold injections has more recently been attributed to Mr. Allan Ramsay, a Scotch anatomist. *(Vide Horner's Practical Anatomy*, p. xviii, *Introduction.)*

### *Mercurial Injections.*

These exact great skill and care in the operator. It requires an iron tube with a finely drawn glass pipe attached, supplied with a stop-cock—they are chiefly used for filling the lymphatics: the pipe must be introduced into these vessels at numerous points most distant from the heart, and these successively charged with the quicksilver.

The lymphatic vessels of the liver, the parotid glands, the vesiculæ seminales, the testicles, the mesentery of the tortoise, the lactiferous ducts of the mammæ, the kidneys of a cat, &c., form the best objects for a successful display of this kind of injection.

The hand of an emaciated individual may be readily injected, both arteries and veins, by fixing the pipe in the radial artery. The vessels are very apt to rupture during this operation, when it had been the custom to throw away the preparation as spoiled. But this accident we have found very readily remedied, by simply touching the ruptured vessel with a red hot wire, when, by the contraction of tonicity, the effusion of the quicksilver is suppressed. After the injection has been completed, the hand must be macerated in water, frequently changed, until the blood and cu-

ticle are removed, when it may be dried and varnished, or suspended in spirits of turpentine.

We have seen admirable preparations in possession of Professor Flourens, in the Museum of the Jardin des Plantes, illustrating the vascular connection between mother and fœtus, by means of both quicksilver and size injections, passed both from the fœtal vessels to those of the uterus, and *vice versa;* a species of connection said to exist in all animals possessed of a simple placenta, and not cotyledinous.

Various other minute particulars connected with anatomical preparations in all its branches, will be found fully detailed in the present volume.